Nurturing Innovation Through Entrepreneurial Ecosystems: What Does the Literature Say?

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Abstract This chapter presents a literature review about entrepreneurial ecosystems and their relationship with entrepreneurship and innovation. Reviewed studies were aggregated into clusters and interpreted through the Neck et al. (J Small Bus Manag 42(2):190–208, 2004) framework, providing a systematised summary of the surveyed literature.

1 Introduction

As an interdisciplinary concept, the definition of entrepreneurship is evolutionary, one that has evolved alongside sociocultural, political and economic developments. The fundamental historical changes within the twentieth century altered the viewpoint of entrepreneurship and the entrepreneur from a one-dimensional actor within the peripheries of economic theory to an individual recognised as a 'risk-taker', 'an innovator', a 'decision-maker' (Ferreira et al. 2017)—a rounded individual who is able to connect different markets and answer market deficiencies. Furthermore, the purpose of entrepreneurship has evolved from solely 'finding and exploiting opportunities' to deriving its theoretical objective in growth and development (Isenberg 2014) via innovation. For example, Du Plessis and Boon (2004) refer to innovation as the creation of new knowledge and ideas to facilitate new business outcomes, aimed at improving business processes and to create market-driven products and services. Others highlight that understanding the interconnection of entrepreneurship and innovation requires an understanding of the environment in which entrepreneurs operate—with a support infrastructure for entrepreneurial activities determining the quality and quantity of results (Feldman et al. 2005).

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When viewing entrepreneurship through the lens of regional (economic) development, the notion of entrepreneurial ecosystems is applied to describe a 'dynamic, self-regulated network' (Isenberg 2014), particularly when explaining the influence of regional and economic factors being supplemented by the entrepreneurial process (Dubini 1989).

For the purpose of this research, the following definition will be utilised throughout—of an entrepreneurial ecosystem as a set of interdependent factors coordinated in such a way that they enable productive entrepreneurship within a particular territory (Stam and Bosma 2015). Within entrepreneurial dimensions, ecosystems focus on the relation of economic, social and cultural attributes, with such interdependent actors interacting and developing over time to create regional enhancement and prosperity (Spigel 2017).

Within academic literature, discussion of entrepreneurship within the context of 'ecosystems' has gained incremental popularity; a noticeable rise is evident post 2008–2009, following the global financial crisis. This is largely due to the recognition of entrepreneurial ecosystems as having huge potential on regional economic growth, job creation and regional and national competitiveness (Spigel 2017).

The topic of entrepreneurial ecosystems is rising in importance for management, entrepreneurs and policymakers, since decision-making focused on ecosystem investment requires a thorough understanding of these dynamic and complex communities (Ross Brown and Mason 2017). However, there is limited published literature on innovation maximisation in the direct context of entrepreneurial ecosystems—due to the niche nature of the topic of interest (Cohen 2006). This systematic literature review aims to synthesise research evidence on entrepreneurial ecosystems, whilst tying entrepreneurship and innovation together through the identification of ecosystem aspects which maximise innovative capacity.

In order to do this, a review of the literature will be conducted to ascertain the evolution of entrepreneurial ecosystem discussion. A dataset of journal articles encompassing both qualitative and quantitative data will be selected and reviewed. Comparisons will be drawn between all articles, based on research methodologies, their theoretical basis, analysis types and results. The results are drawn together to establish which mentioned aspects of entrepreneurial ecosystems maximise innovative capacity.

2 Theory: An Evolution of the Topic from Clusters to Current Perceptions

The focus on the external environment and its impact on the firm began primarily with the study of clusters, as introduced by Porter (1985). The cluster approach focuses on 'geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (. . .) in particular fields that compete but also co-operate' (Porter 1998). The primary

focus was on the role of innovative firms in enhancing regional and national competitiveness—particularly by using regional productivity as a measure of national competitiveness (Stam and Bosma 2015). However recent academic research on 'clusters' has shifted to a focus on 'ecosystems' and has a more interdisciplinary nature.

The initial focus of the topic was aimed at identifying the various structural components of an 'entrepreneurial ecosystem'. Van de Ven's (1993) focus on the creation of the entrepreneurial ecosystem stressed the holistic stance with which entrepreneurship should be approached. Regarding the institutional theory, North (1990) stressed the role of institutions as facilitators of market relations and instigators of societal progress. This highlighted the role of governance within ecosystems, alongside the role of individual entrepreneurs, investors, venture capitalists, organisations, incubators and universities as being critical junctures within entrepreneurial ecosystems (Bahrami and Evans 1995).

Additionally, others (Douglas and Shepherd 2000; Florida and Kenney 1988; Spilling 1996) stressed the importance of the interactions between interdependent components of the ecosystem which cannot be overlooked—after which, research adopted a holistic stance on the relative contributions of ecosystem components to the entire system. Furthermore, the role of network theory is particularly notable during this period—specifically social, formal and informal connections—in shaping the course of entrepreneurial ecosystem research. This is a vital point in the development of the topic, since it eliminated the physical boundaries which cluster theory heavily implemented on the function and scope of entrepreneurial ecosystems and disproved current theorists on their depiction of entrepreneurial ecosystems as geographically bounded areas (Auerswald 2015). Furthermore, it embedded branches of social sciences within entrepreneurship-based research (Baycan Levent et al. 2003; Lefebvre et al. 2015)—a key moment for the topic, since it contextualised the topic beyond the peripheries of economic theory.

Literature defines 'innovation ecosystems' (Markman and Baron 2003) as interconnected networks of entities that co-evolve capabilities around a shared set of knowledge and skills and work cooperatively but competitively. Although not dissimilar from the definition of entrepreneurial ecosystems, there is an attempt in recent literature to create a disparity when associating innovation and entrepreneurship—most notably with the development of the MIT REAP framework. This framework refers to entrepreneurs and innovators as separate entities, although the two actors share similar skills and characteristics: both being opportunity spotters, using the process of learning and discovery to create value whilst being able to operate in uncertain environments with a high tolerance for ambiguity (Sarasvathy et al. 2008). The incremental disassociation of innovation from the entrepreneur counters the valuable theoretical basis for entrepreneurship and must retain close association (Dahlstrand and Stevenson 2010).

A number of entrepreneurial ecosystem frameworks exist in current literature. Spearheaded by Isenberg (2014) thirteen-factor ecosystem model, literature began to incorporate factors relating to social sciences into their models: for example, Spigel's

(2017) framework categorised its components into three sections: material, social and cultural types of attributes which constructed the framework.

The chosen framework for the review was the Neck et al. (2004) model of entrepreneurial ecosystem components: the authors were one of the first to create a holistic presentation of the interaction of multiple ecosystem components (Cohen 2006), since the framework was developed during the emerging years of entrepreneurial ecosystem literature. Rigorous research and comparisons made against other frameworks confirmed Neck et al. (2004) to be an effective basis framework for the literature review. Neck et al. (2004) produced a clear taxonomy of ecosystem components, with diverse categories making it applicable for the study of a large selection of articles, whilst the clarity of the model makes it effective when comparing several studies.

3 Method

The systematic literature review was chosen as appropriate method for this research. A systematic review seemed more applicable than other styles of literature reviews since its aim is to answer a predefined research question, based on 'what' and 'how' (rather than 'why') questions (e.g. Abatecola et al. 2013; Caputo 2013a). The aim of the research was to collate as many relevant existing studies on the chosen discipline and to assess the extent to which they adhere to the selected theoretical framework by Neck et al. (2004).

Consistently with the principles of systematic literature review (Tranfield et al. 2003), after the initial creation of a research protocol to promote the transparency of methods, the literature review was completed through a three-step process. The formed review panel consisted of an academic with specialist knowledge in the field, in addition to complimentary experience in the use of systematic reviews. The panel proved useful in aiding the selection of the correct style of literature review, most applicable for the topic of interest. Additional help was focused on exploring the boundaries of the research methodology, as well as helping to determine the inclusion and exclusion criteria.

The review was limited to published journal articles (reviewed) in English language—specifically, both empirical and theoretical articles discussing the topic. The focus of these case studies could be on ecosystems in all levels of development (i.e. growing or maturing), with a particularly preference for ecosystem examples composed of representatives from several industries—since this made the outcome of the research applicable to more than one industry. The articles were selected from one search platform, Scopus. In order to ensure the relevance of the selected articles, the search criteria were limited to sources from Economics and Management disciplines only. Research on selected articles was conducted on the Abstract during the initial screening. The search for the articles was completed through a refined search string, developed from previous knowledge acquired from the preliminary literature search, as well as guidance from the expertise of the panel. The final search string of *TITLE-*

ABS-KEY (entrepren∗ OR start∗up∗) AND (ecosystem∗ AND innov∗) was selected, on the basis that it produced articles with these keywords in the title or the abstract, as well as allowing flexibility in the breadth of discussion. This produced 427 results.

The initial review was conducted by searching through the 'Author Key Words' tab on the exported dataset, to eliminate articles from disciplines stated in the protocol's exclusion criteria (e.g. Social Sciences). A total of 70 articles were exported from Scopus, having been published between the years 2006 and 2017. A critical analysis was carried out next, by searching the abstracts for specific keywords, which would determine whether they would be included/excluded from the dataset. An example exclusion keyword is 'clusters', since it is often associated with the topic of entrepreneurial ecosystems yet has close affiliations with theory of entrepreneurial clusters (Delgado et al. 2010). Other articles eliminated from the dataset were those which contorted the meaning of 'ecosystem' on a regional level: specifically, by referring to industry ecosystems or national ecosystems. Originally, the exclusion criteria of eliminating studies based on emerging economies were applied throughout the screening process—however, this was reversed once the value potential of these case studies was evident, since these articles were the ones most likely to present an evolutionary perspective on the development and maturity of ecosystems. This holds great value to the topic of interest, since there is potential to identify those elements of entrepreneurial ecosystems which maximise innovative capacity over time and how these evolve with ecosystems.

Following this elimination, a total of 47 articles were taken into consideration for a full-text screening. During this part of the method, objective inclusion and exclusion criteria were strictly adhered to, since there was a high level of ambiguity within some studies, as to how they could be valid for inclusion. Each article was read in full at least twice, in order to gain full familiarity with the content, thus ensuring sound judgement with minimal subjectivity and bias. Two articles were eliminated following a critical appraisal of the dataset, 13 articles were excluded due to conditions set out by close adherence to the exclusion criteria, and 5 articles had restricted access and therefore were requested through interlibrary loans and personal requests to authors. Out of those received ($n = 5$), two were included in the final dataset, whilst the remaining three were deemed either irrelevant or had a predominant focus on patent pools (Vakili 2016).

During the secondary scoping of literature, each article was assigned to at least one Neck et al. (2004) framework component, based on what the content of each study had affiliated with as the aspect(s) which maximised innovative capacity of entrepreneurial ecosystems.

3.1 Characteristics of the Final Dataset

The dataset consisted of 23 empirical studies, four theoretical and two using a mixed research approach (both theoretical and empirical). This size is consistent with some

previously published research in management literature (Abatecola et al. 2012; Caputo 2013a, b; Caputo et al. 2016).

Within this population, 22 used qualitative methodology when collecting data, one used a solely quantitative approach, whilst five used a mixed methodology. Of the 22 studies using a qualitative research design, most of these conducted primary research, whilst five used a mixed method approach: i.e. integrating primary and secondary research on a case study ($n = 2$). Primary research was characterised by open-ended interviews ($n = 8$), questionnaires ($n = 3$) and surveys ($n = 2$), which were later synthesised, systemised or coded to support data analysis. The proportion of qualitative methodologies is advantageous since these simplify and manage large amounts of data without destroying complexity and context (Atieno 2009). The one article which used a quantitative research design (Samila and Sorenson 2010) conducted a longitudinal study, spanning 9 years, covering 328 metropolitan statistical areas in the USA—out of the dataset, it is the article with the highest number of citations ($n = 47$) yet openly seeks a correlation between public funding and fostering innovation in ecosystems. It is interesting to note that those studies using a mixed research approach primarily focused on the role of networking within ecosystems and advocated the need to code large amounts of qualitative data, before a qualitative analysis.

4 Clusterisation of Findings by Theory

The dataset was segmented into respective clusters (See Table 1). First, those articles which utilised theory ($n = 23$) as a lens to explore the topic of interest were assigned to a theoretical cluster. The clusters identified were represented by four respective theoretical settings: innovation systems theories, variance theories and network and

Table 1 The distributions of articles across clusters

Cluster	Authors
Innovation systems $N = 11$	van den Heiligenberg et al. (2017), Brem and Radziwon (2017), Dubina et al. (2017), Van Gils and Rutjes (2017), Brown (2016), Euchner (2016), Guerrero et al. (2014), Merrie and Olsson (2014), Kim et al. (2012), MacGregor et al. (2010)
Network theory $N = 6$	Huang-Saad et al. (2017), Cannavacciuolo et al. (2017), Schaeffer and Matt (2016), Carayannis et al. (2016), Kantarelis (2009)
Variance theory $N = 5$	Ansari et al. (2016), Stough (2016), Fernández Fernández et al. (2015), Carayannis et al. (2015), O'Connor et al. (2012)
Agency theory $N = 1$	Hayter (2016)
No theory $N = 6$	Baroncelli and Landoni (2017), Ferreira et al. (2017), Usman and Vanhaverbeke (2017), Tietz et al. (2015), Letaifa and Rabeau (2013), Samila and Sorenson (2010)

Source: Table compiled by the authors

agency theory. These clusters were identified on the basis that they represented the theoretical components of all articles within the dataset well, whilst providing a snapshot of various relationship types between ecosystem components presented by these theories. For the benefit of comparability, each article was assigned to one cluster only.

4.1 Innovation Systems

Studies grouped in the 'innovation systems' cluster viewed ecosystem components within a holistic perspective of system agents and their environment, where the principal goal is to develop and diffuse innovations.

The innovation systems cluster was dominated by three streams of studies: the triple helix concept (Brem and Radziwon 2017; Dubina et al. 2017; Kim et al. 2012; MacGregor et al. 2010), regional innovation systems (Brown 2016; van den Heiligenberg et al. 2017) and models constructed by the authors specifically for the geographical context discussed in these articles (Euchner 2016; Merrie and Olsson 2014; van Gils and Rutjes 2017).

The triple helix refers to a growing triadic relationship between university-industry-government. This is a concept commonly discussed within the context of innovations systems, yet the chosen articles apply these dynamic relationships to entrepreneurial ecosystems. Moreover, the authors discussed recognise the contribution of triple helix configurations to the maximisation of innovative capacity within ecosystems—by exemplifying that the successful interaction between the ecosystem members emerges at the intersection of national culture, the political and legal systems and entrepreneurial cognition (Nambisan and Baron 2013). Dubina et al. (2017) utilise the triple helix lens to identify how ecosystems can develop in a sustainable way, in the context of economies in transition (i.e. Russia). Contrasting to Brem and Radziwon (2017), the authors state the role of universities as 'initiators of innovation', thus crediting these institutions as heavy contributors to maximisation of innovative capacity within these ecosystems.

The second dominant theory within the innovation systems cluster is regional innovation systems (RIS)—a theoretical basis which frames innovation as an output of various combinations of political, cultural and economic forces within geographic proximity. Within this grouping, RIS theory has been used to discuss regional competitive advantage, university-industry collaboration (UIC) through the lens of a multidimensional policy framework and the role of universities as epicentres of such systems. Much like the triple helix concept, the RIS theoretical lens highlights the role of connectivity between ecosystem components, particularly with universities—a central source of innovative development (Charles 2006).

It is interesting to note that the remainder of the articles within the innovation systems cluster do not frame their studies through a single theoretical lens; however, a trend is evident in the way they perceive their case studies—this is through central focus on the diffusion of innovation. These articles indicate that the need to consider

how innovative ideas are diffused throughout the ecosystem is imperative—especially once ecosystem relationships are formulated and established.

4.2 Network Theory

The theoretical cluster of 'network theory' focuses on the type of relationships which define the characteristics of entrepreneurial ecosystems—viewing networks as facilitators of knowledge flows within and across regions, to act as a key source of innovation and growth (Huggins and Williams 2011; Huggins and Johnston 2009). Within the dataset, networks are viewed as a form of capital amongst ecosystem members through the establishment of valuable connections between individual entrepreneurs, agents and institutions. Naturally, this contributes to maximising the innovative capacity of ecosystems—the following explores the various forms of networking illustrated within the cluster.

Within this grouping, once again, the role of universities is highlighted as a central player in innovation maximisation—particularly entrepreneurial universities seeping information and innovation into the ecosystem via spin-offs and knowledge spillovers. Huang-Saad et al. (2017) investigate the network opportunities which universities create via university-entrepreneurship programmes aimed at cultivating entrepreneurial graduates, through the creation of a direct network between university innovations and entrepreneurial initiatives (Huang-Saad et al. 2017). Schaeffer and Matt (2016) credit the role of technology transfer offices (TTOs) set up by universities, as intermediaries within non-mature ecosystems, leading to the progressive development of innovative intermediaries within ecosystems to accommodate the exchange of entrepreneurial resources (Spigel 2017).

Although the network theory cluster is dominated by discussion of university spillovers to industry through network intermediaries, one study (Cannavacciuolo et al. 2017) focuses on the emergence of collaborative networks in entrepreneurial ecosystems as determined by the way entrepreneurs exchange knowledge. It places responsibility on the entrepreneur to create such networks and enhance these by learning through business transactions with other entrepreneurs. It is interesting to highlight the connection between learning and the development of networking capabilities, since the authors claim that network systems are learning systems.

Overall, two perspectives dominate the cluster—the networking opportunities instigated by institutions (i.e. universities) and those opportunities sought and created by entrepreneurs themselves. Although both are vital to the exchange of ideas and the creation of collaborative knowledge to form inevitable innovations, it is clear that this cluster stresses the importance of different tiers of networking within ecosystems, to create a baseline for maximising innovative capacity within an ecosystem.

4.3 Variance Theory

The 'variance theory' cluster explores the basic fundamentals of how variance in dependent variables within the ecosystem was based on changes of one or more independent variables. This is an important theoretical aspect since it understood that the agents within an entrepreneurial ecosystem do not necessarily change over time, but their properties and value potential do, and that these variations are what drive ecosystem relationships. Ansari et al. (2016) discuss the notion of disruptive innovations within an ecosystem dominated by a single industry and make a case for considering the impact of each ecosystem actors' action on how it will impact the rest of the ecosystem—thus highlighting the downside of interconnectedness. The remainder of the articles within the cluster focus on the creation of stable ecosystem conditions to supplement the creation of links between its actors, to form a sustainable entrepreneurial ecosystem (Fernández Fernández et al. 2015; O'Connor et al. 2012).

4.4 Agency Theory

Articles assigned to the 'agency theory' cluster exclusively explored the relationship between principles and agents in the ecosystem—more specifically, exploring the problems that occur when one agent represents a principle, especially when the principle and agent do not share the same goals (e.g. government-university relationships).

The one article assigned to this cluster mainly discusses the role of networking in complimenting the progressive capabilities of the ecosystem: much like Schaeffer and Matt (2016), Hayter (2016) investigates the role of knowledge intermediaries—specifically, academic and non-academic contacts who connect faculty and students to other social networks important to spin-off success.

5 Clusterisation of Findings According to the Neck et al. (2004) Framework

The allocation of studies to different components of Neck et al.'s (2004) framework is presented in Table 2. The table helps to identify the framework component with the highest concentration of articles supporting its ability to maximise innovative capacity within an ecosystem.

The number of allocations totalled 73—meaning that the 29 articles in the dataset were allocated to at least two model components on average (i.e. more than one aspect was believed to have had an effect on the maximisation of innovative capacity). As evident from Table 2, the framework components with the highest

Table 2 The allocation of all articles to applicable framework components

Neck et al. (2004) framework	Authors reviewed in the study
University $N = 13$	Baroncelli and Landoni (2017), Brem and Radziwon (2017), Guerrero et al. (2014), Huang-Saad et al. (2017), Hayter (2016), Brown (2016), Stough (2016), Schaeffer and Matt (2016), Kim et al. (2012), O'Connor et al. (2012), Kantarelis (2009)
Government $N = 11$	Guerrero et al. (2014), van den Heiligenberg et al. (2017), Brem and Radziwon (2017), Dubina et al. (2017), Brown (2016), Stough (2016), Carayannis et al. (2015), Letaifa and Rabeau (2013), Kim et al. (2012), O'Connor et al. (2012)
Capital services $N = 10$	Baroncelli and Landoni (2017), van den Heiligenberg et al. (2017), Dubina et al. (2017), Schaeffer and Matt (2016), Carayannis et al. (2015), O'Connor et al. (2012), Kim et al. (2012), Samila and Sorenson (2010), MacGregor et al. (2010)
Professional and support services $N = 9$	Baroncelli and Landoni (2017), Usman and Vanhaverbeke (2017), Huang-Saad et al. (2017), Schaeffer and Matt (2016), Hayter (2016), Brown (2016), MacGregor et al. (2010)
Formal network $N = 8$	Usman and Vanhaverbeke (2017), Guerrero et al. (2014), van den Heiligenberg et al. (2017), Brem and Radziwon (2017), Van Gils and Rutjes (2017), Euchner (2016), Huang-Saad et al. (2017), Hayter (2016)
Incubator $N = 4$	Baroncelli and Landoni (2017), Van Gils and Rutjes (2017), Tietz et al. (2015), Fernández Fernández et al. (2015)
Culture $N = 5$	Van Gils and Rutjes (2017), Stough (2016), Hayter (2016), Merrie and Olsson (2014), Leteifa and Rabeau (2013)
Large corporations $N = 4$	Usman and Vanhaverbeke (2017), Euchner (2016), Stough (2016), Kantarelis 2009
Informal network $N = 3$	Brem and Radziwon (2017), Van Gils and Rutjes (2017), Hayter (2016)
Talent pool $N = 3$	Usman and Vanhaverbeke (2017), Huang-Saad et al. (2017), Carayannis et al. (2015)
Physical infrastructure $N = 1$	Kim et al. (2012)

Source: Table compiled by the authors

concentration of article allocation are university ($n = 13$), government ($n = 11$) and capital services ($n = 10$). This implies that institutional presence and input to the ecosystem had the highest impact over innovation maximisation. For example, Stough's (2016) research highlights how 'regional governance and institutions are particularly critical components of regional entrepreneurial ecosystem performance', whilst Kim et al. (2012) highlight the positive synergistic effects of interactions between regional government, university contributions and capital availability for entrepreneurial activity.

The next group of framework components with the highest allocation of articles consist of: professional and support services ($n = 9$), formal network ($n = 8$), the culture of the ecosystem ($n = 5$) and incubator spin-off relationships ($n = 4$). Despite

the lower proportion of articles allocated to these framework components, aspects such as 'culture' should be interpreted with care, since it is a more miscellaneous and general contributor to innovation maximisation—acting as a general indication of the norms and attitudes of individual, prior to the birth of the entrepreneurial ecosystem itself (Godwyn and Gittell 2011). 'Support services' should also be considered with caution, since the variety of such resources is an indication of the attitudes towards entrepreneurial activity within the ecosystem. These framework components are indicative of the social support and encouragement of entrepreneurial activity within the ecosystem—despite the lower allocation of dataset articles to these components, they are vital contributors towards innovation maximisation within an ecosystem, since favourable attitudes and encouraging support services for entrepreneurs will encourage innovative products and services to be brought to the market, whilst encouraging firm survival within a dynamic environment (Coduras et al. 2008).

With respect to formal networks, Usman and Vanhaverbeke's (2017) discussion is focused on the potential for innovative output when start-ups and large firms collaborate—specifically, how management of these relationships can maximise innovative output. On the other hand, Hayter (2016) presents an expansive perspective on formal networks, highlighting the contribution of institutional and individual intermediaries (such as incubators) to innovation and entrepreneurial ecosystems—particularly using the role of academics acting as intermediaries in 'connecting faculty and students to other social networks important to spin-off success'. A similar perspective is held by those articles allocated to the 'incubator' component of the Neck et al. framework; however all authors highlight that advantages derived from incubator presence within the ecosystem must be supported by available resources (services and resources) and access to capital, whilst incubator self-protectionism and bureaucracy can act as a significant barrier to innovative output within ecosystems (Tietz et al. 2015).

Large corporations ($n = 4$), informal network ($n = 3$), talent pool ($n = 2$) and the physical infrastructure ($n = 1$) had the fewest allocations from the article population. The low weighting of articles allocated to these components is likely justified by the fact that these framework components acted as secondary allocations—meaning that these were discussed in the context of more prevalent components identified as maximising innovative capacity within an ecosystem (Euchner 2016; Kantarelis 2009; Usman and Vanhaverbeke 2017; van den Heiligenberg et al. 2017). For example, those articles focusing on 'informal network' highlight its importance in maximising the innovative capacity of an ecosystem, in the background of formal network discussions (van Gils and Rutjes 2017).

Although most articles present one aspect of the framework as being most dominant in maximising the innovative capacity of entrepreneurial ecosystems, it is important to note the context within which these framework components are discussed in. More importantly, it should be noted that a single framework component cannot maximise innovative capacity of an ecosystem without working in conjunction with at least one other aspect of the framework. Although contributions from institutions, the government and capital services hold great value in encouraging and facilitating innovative projects, these would not be sustained without

interconnectivity with the remainder of the framework components and would therefore inhibit the formation of incremental and/or radical entrepreneurial innovations.

6 Conclusion

Universities, capital services and the government seem to have the largest impact on maximising innovative capacity of an entrepreneurial ecosystem, based on the high proportion of articles allocated to the components of the Neck et al. (2004) framework. Although this is a close combination to the triple helix model, analysis of article results reveals more preeminent conditions for innovation maximisation. It was a common theme through the analysis that contextual considerations of each ecosystem are equally as important—just as the habitat conditions are vital to sustain growth within biological ecosystems, maintaining the interconnectedness of ecosystem actors and encouragement of entrepreneurial activity through the culture, incubators and support services is equally as important as institutional presence and capital availability.

Neck et al. (2004) framework proved highly effective as a model used within the review with the selected dataset. It is composed of at least one ecosystem component mentioned within the articles, whilst presenting a wide range of options to generate insightful and meaningful results. However, there is potential for its improvement through the contribution of the dataset research—since many articles identified ecosystem aspects which were not mentioned in the framework. A prominent factor mentioned amongst five of the articles was the role of defining and implementing a proactive ecosystem strategy which firms, institutions and individuals can use when forging the direction of innovations. This way capital, academic and entrepreneurial input will be used more efficiently, with a clear strategy which will create direction and support transparent cooperation. Finally, a strong collaborative ethos between institutions and circles of networks is repeatedly highlighted as encouraging of innovative activity—especially since industry-institutional collaborations will implement knowledge exchange benefitting both parties.

While this research contributes to our knowledge of entrepreneurial ecosystems by clarifying the aspects of these which increase innovative capacity, the most valuable finding is that innovation *maximisation* derives from a holistic perspective of ecosystem components and actors, working towards a common strategy—rather than focusing investment on a select few aspects, the ecosystem should be viewed as a single entity, with investment and policy initiated to integrate and mutually benefit.

References

Abatecola, G., Cafferata, R., & Poggesi, S. (2012). Arthur Stinchcombe's "liability of newness": Contribution and impact of the construct. *Journal of Management History, 18*(4), 402–418.

Abatecola, G., Caputo, A., Mari, M., & Poggesi, S. (2013). Real estate management: Past, present and future research directions. *International Journal of Globalisation and Small Business, 5* (1/2), 98–113.

Ansari, S. S., Garud, R., & Kumaraswamy, A. (2016). The disruptor's dilemma: TiVo and the U.S. television ecosystem. *Strategic Management Journal, 37*(9), 1829–1853. https://doi.org/10.1002/smj.2442

Atieno, O. P. (2009). An analysis of the strengths and limitation of qualitative and quantitative research paradigms. *Problems of Education in the 21st Century, 13*(1), 13–38.

Auerswald, P. E. (2015). *Enabling entrepreneurial ecosystems: Insights from ecology to inform effective entrepreneurship policy*. Kauffman Foundation Research series on city, metro, and regional entreprenurship. Kansas City, MO: Ewing Marion Kauffman Foundation.

Bahrami, H., & Evans, S. (1995). Flexible re-cycling and high-technology entrepreneurship. *California Management Review, 37*(3), 62–89. https://doi.org/10.2307/41165799

Baroncelli, A., & Landoni, M. (2017). Exploring differences in university support practices and the effects on spin-off companies in Boston. *International Journal of Entrepreneurship and Innovation Management, 21*, 366–394.

Baycan Levent, T., Masurel, E., & Nijkamp, P. (2003). Diversity in entrepreneurship: Ethnic and female roles in urban economic life. *International Journal of Social Economics, 30*(11), 1131–1161.

Brem, A., & Radziwon, A. (2017). Efficient triple helix collaboration fostering local niche innovation projects – A case from Denmark. *Technological Forecasting and Social Change, 123*, 130–141. https://doi.org/10.1016/j.techfore.2017.01.002

Brown, R. (2016). Mission impossible? Entrepreneurial universities and peripheral regional innovation systems. *Industry and Innovation, 23*(2), 189–205. https://doi.org/10.1080/13662716.2016.1145575

Brown, R., & Mason, C. (2017). Looking inside the spiky bits: A critical review and conceptualisation of entrepreneurial ecosystems. *Small Business Economics, 49*(1), 11–30.

Cannavacciuolo, L., Iandoli, L., Ponsiglione, C., & Zollo, G. (2017). Learning by failure vs learning by habits: Entrepreneurial learning micro-strategies as determinants of the emergence of co-located entrepreneurial networks. *International Journal of Entrepreneurial Behaviour and Research, 23*(3), 524–546. https://doi.org/10.1108/IJEBR-11-2015-0238

Caputo, A. (2013a). A literature review of cognitive biases in negotiation processes. *International Journal of Conflict Management, 24*(4), 274–398. https://doi.org/10.1108/IJCMA-08-2012-0064

Caputo, A. (2013b). The third who joins a negotiation: A systematic review of the literature. *International Journal of Business and Globalisation, 10*(3), 256–277. https://doi.org/10.1504/IJBG.2013.052987

Caputo, A., Pellegrini, M. M., Dabic, M., & Dana, L.-P. (2016). Internationalisation of firms from Central and Eastern Europe. *European Business Review, 28*(6), 630–651. https://doi.org/10.1108/EBR-01-2016-0004

Carayannis, E., Meissner, D., & Edelkina, A. (2015). Targeted innovation policy and practice intelligence (TIP2E): concepts and implications for theory, policy and practice. *The Journal of Technology Transfer, 42*, 460–484.

Carayannis, E., Campbell, D., & Rehman, S. (2016). Mode 3 knowledge production: Systems and systems theory, clusters and networks. *Journal of Innovation and Entrepreneurship, 5*, 17.

Charles, D. (2006). Universities as key knowledge infrastructures in regional innovation systems. *Innovation: The European Journal of Social Science Research, 19*(1), 117–130.

Coduras, A., Urbano, D., Rojas, Á., & Martínez, S. (2008). The relationship between university support to entrepreneurship with entrepreneurial activity in Spain: A GEM data based analysis. *International Advances in Economic Research, 14*(4), 395–406.

Cohen, B. (2006). Sustainable valley entrepreneurial ecosystems. *Business Strategy and the Environment, 15*(1), 1–14. https://doi.org/10.1002/bse.428

Dahlstrand, A. L., & Stevenson, L. (2010). Innovative entrepreneurship policy: Linking innovation and entrepreneurship in a European context. *Annals of Innovation & Entrepreneurship, 1*(1), 5602.

Delgado, M., Porter, M., & Stern, S. (2010). Clusters and entrepreneurship. *Journal of Economic Geography, 10*(4), 495–518.

Douglas, E. J., & Shepherd, D. A. (2000). Entrepreneurship as a utility maximizing response. *Journal of Business Venturing, 15*(3), 231–251.

du Plessis, M., & Boon, J. A. (2004). Knowledge management in eBusiness and customer relationship management: South African case study findings. *International Journal of Information Management, 24*(1), 73–86.

Dubina, I. N., Campbell, D. F. J., Carayannis, E. G., Chub, A. A., Grigoroudis, E., & Kozhevina, O. V. (2017). The balanced development of the spatial innovation and entrepreneurial ecosystem based on principles of the systems compromise: A conceptual framework. *Journal of the Knowledge Economy, 8*(2), 438–455. https://doi.org/10.1007/s13132-016-0426-0

Dubini, P. (1989). The influence of motivations and environment on business start-ups: Some hints for public policies. *Journal of Business Venturing, 4*(1), 11–26.

Euchner, J. (2016). Emerging models for corporate innovation. *Research Technology Management, 59*(1), 56–60. https://doi.org/10.1080/08956308.2016.1117336

Feldman, M., Francis, J., & Bercovitz, J. (2005). Creating a cluster while building a firm: Entrepreneurs and the formation of industrial clusters. *Regional Studies, 39*(1), 129–141.

Fernández Fernández, M. T., Blanco Jiménez, F. J., & Cuadrado Roura, J. R. (2015). Business incubation: Innovative services in an entrepreneurship ecosystem. *Service Industries Journal, 35*(14), 783–800. https://doi.org/10.1080/02642069.2015.1080243

Ferreira, J. J., Fayolle, A., Fernandes, C., & Raposo, M. (2017). Effects of Schumpeterian and Kirznerian entrepreneurship on economic growth: Panel data evidence. *Entrepreneurship and Regional Development, 29*(1–2), 27–50. https://doi.org/10.1080/08985626.2016.1255431

Florida, R. L., & Kenney, M. (1988). Venture capital, high technology and regional development. *Regional Studies, 22*(1), 33–48.

Godwyn, M., & Gittell, J. H. (2011). *Sociology of organizations: Structures and relationships*. Los Angeles: Sage.

Guerrero, M., Urbano, D., Cunningham, J., & Organ, D. (2014). Entrepreneurial universities in two European regions: a case study comparison. *Journal of Technology Transfer, 39*, 415–434.

Hayter, C. S. (2016). A trajectory of early-stage spinoff success: The role of knowledge intermediaries within an entrepreneurial university ecosystem. *Small Business Economics, 47*(3), 633–656. https://doi.org/10.1007/s11187-016-9756-3

Huang-Saad, A., Fay, J., & Sheridan, L. (2017). Closing the divide: Accelerating technology commercialization by catalyzing the university entrepreneurial ecosystem with I-Corps™. *Journal of Technology Transfer, 42*(6), 1466–1486. https://doi.org/10.1007/s10961-016-9531-2

Huggins, R., & Johnston, A. (2009). Knowledge networks in an uncompetitive region: SME innovation and growth. *Growth and Change, 40*(2), 227–259.

Huggins, R., & Williams, N. (2011). Entrepreneurship and regional competitiveness: The role and progression of policy. *Entrepreneurship and Regional Development, 23*(9–10), 907–932. https://doi.org/10.1080/08985626.2011.577818

Isenberg, D. (2014). What an entrepreneurship ecosystem actually is. *Harvard Business Review, 5*, 1–7.

Kantarelis, D. (2009). Entrepreneurship in the USA: Architecture, market structure and incentives. *International Journal of Entrepreneurship and Innovation Management, 9*(3), 191–203. https://doi.org/10.1504/IJEIM.2009.025139

Kim, Y., Kim, W., & Yang, T. (2012). The effect of the triple helix system and habitat on regional entrepreneurship: Empirical evidence from the U.S. *Research Policy, 41*(1), 154–166. https://doi.org/10.1016/j.respol.2011.08.003

Lefebvre, V., Radu Lefebvre, M., & Simon, E. (2015). Formal entrepreneurial networks as communities of practice: A longitudinal case study. *Entrepreneurship & Regional Development, 27*(7–8), 500–525.

Letaifa, S., & Rabeau, Y. (2013). Too close to collaborate? How geographic proximity could impede entrepreneurship and innovation. *Journal of Business Research, 66*(10), 2071–2078.

MacGregor, S. P., Marques-Gou, P., & Simon-Villar, A. (2010). Gauging readiness for the quadruple helix: A study of 16 European organizations. *Journal of the Knowledge Economy, 1*(3), 173–190. https://doi.org/10.1007/s13132-010-0012-9

Markman, G. D., & Baron, R. A. (2003). Person–entrepreneurship fit: Why some people are more successful as entrepreneurs than others. *Human Resource Management Review, 13*(2), 281–301.

Merrie, A., & Olsson, P. (2014). An innovation and agency perspective on the emergence and spread of marine spatial planning. *Marine Policy, 44*, 366–374. https://doi.org/10.1016/j.marpol.2013.10.006

Nambisan, S., & Baron, R. A. (2013). Entrepreneurship in innovation ecosystems: Entrepreneurs' self-regulatory processes and their implications for new venture success. *Entrepreneurship Theory and Practice, 37*(5), 1071–1097. https://doi.org/10.1111/j.1540-6520.2012.00519.x

Neck, H. M., Meyer, G. D., Cohen, B., & Corbett, A. C. (2004). An entrepreneurial system view of new venture creation. *Journal of Small Business Management, 42*(2), 190–208.

North, D. C. (1990). A transaction cost theory of politics. *Journal of Theoretical Politics, 2*(4), 355–367.

O'Connor, J., Fenton, M., & Barry, A. (2012). Entrepreneurship education: Ireland's solution to economic regeneration? *Industry and Higher Education, 26*(3), 241–249. https://doi.org/10.5367/ihe.2012.0097

Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance* (Vol. 43, p. 214). New York: Free Press.

Porter, M. E. (1998). Clusters and the new economics of competition. *Harvard Business Review, 76*, 77–90.

Samila, S., & Sorenson, O. (2010). Venture capital as a catalyst to commercialization. *Research Policy, 39*(10), 1348–1360. https://doi.org/10.1016/j.respol.2010.08.006

Sarasvathy, S. D., Dew, N., Read, S., & Wiltbank, R. (2008). Designing organizations that design environments: Lessons from entrepreneurial expertise. *Organization Studies, 29*(1), 331–350.

Schaeffer, V., & Matt, M. (2016). Development of academic entrepreneurship in a non-mature context: The role of the university as a hub-organisation. *Entrepreneurship and Regional Development, 28*(9–10), 724–745. https://doi.org/10.1080/08985626.2016.1247915

Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice, 41*(1), 49–72.

Spilling, O. R. (1996). The entrepreneurial system: On entrepreneurship in the context of a mega-event. *Journal of Business Research, 36*(1), 91–103.

Stam, E., & Bosma, N. (2015). Local policies for high-growth firms. In D. Audretsch, A. Link, & A. Walshok (Eds.), *Oxford handbook of local competitiveness* (pp. 286–305). Oxford: Oxford University Press.

Stough, R. R. (2016). Entrepreneurship and regional economic development: Some reflections. *Investigaciones Regionales, 2016*(36), 129–150. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006087894&partnerID=40&md5=8aaf65444f85446faa8d585f2d4319db

Tietz, G., Anholon, R., Ordoñez, R. E. C., & Quelhas, O. L. (2015). Business incubators in Brazil: Main gaps to be explored by academic researchers. *Journal of Technology Management and Innovation, 10*(4), 18–27. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84949955880&partnerID=40&md5=77fcf93f516dda13b493a31ff1501fec

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207–222.

Usman, M., & Vanhaverbeke, W. (2017). How start-ups successfully organize and manage open innovation with large companies. *European Journal of Innovation Management, 20*(1), 171–186. https://doi.org/10.1108/EJIM-07-2016-0066

Vakili, K. (2016). Collaborative promotion of technology standards and the impact on innovation, industry structure, and organizational capabilities: Evidence from modern patent pools. *Organization Science, 27*(6), 1504–1524. https://doi.org/10.1287/orsc.2016.1098

Van de Ven, H. (1993). The development of an infrastructure for entrepreneurship. *Journal of Business Venturing, 8*(3), 211–230.

van den Heiligenberg, H. A. R. M., Heimeriks, G. J., Hekkert, M. P., & van Oort, F. G. (2017). A habitat for sustainability experiments: Success factors for innovations in their local and regional contexts. *Journal of Cleaner Production, 169*, 204–215. https://doi.org/10.1016/j.jclepro.2017.06.177

van Gils, M. J. G. M., & Rutjes, F. P. J. T. (2017). Accelerating chemical start-ups in ecosystems: The need for biotopes. *European Journal of Innovation Management, 20*(1), 135–152. https://doi.org/10.1108/EJIM-10-2015-0102