

The evolutionary dynamics of entrepreneurial ecosystems

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Abstract

Entrepreneurial ecosystems (EE) consist of interacting components, which foster new firm formation and associated regional entrepreneurial activities. Current work on EE, however, focuses on documenting the presence of system components, which means there is little understanding of interdependencies between EE components and their evolutionary dynamics. To address these issues, the objective of the present study is to develop an evolutionary framework of EE development that integrates important components from prior work and describes how critical elements of an entrepreneurial system interact and evolve over time. The value of this framework in understanding the evolutionary dynamics of EE will be demonstrated by profiling the EE of Phoenix, Arizona. The evolutionary perspective developed is valuable because it provides a sense of how history, culture and the institutional setting impact EE. It also provides stakeholders with action points to help maintain or propel an EE to the next level. This is a distinct improvement over static approaches that provide a list of EE ingredients with no sense of their relative importance over time. The proposed framework may also be used in a comparative context to compare and contrast the evolutionary trajectory of EE to better understand why particular places remain trapped in a specific phase of growth or continue to evolve over time.

Keywords

economic development, entrepreneurial ecosystem, entrepreneurship, evolutionary, geography, policy, regional milieu

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Introduction

Studies of entrepreneurial ecosystems (EE) provide valuable information about the components of EE (Cohen, 2006; Isenberg, 2010, 2011; Neck et al., 2004) with a focus on profiling successful EE (Feld, 2012; Oden, 1997;

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Saxenian, 1994). While valuable, more work is needed to characterise EE where the pre-conditions for entrepreneurial activity are not as favourable as those highlighted in successful profiles. Additional research is also needed to understand interdependencies between EE components and their evolutionary dynamics to help evaluate the relative importance of EE components over time (Cohen, 2006).

Related work on high-technology districts notes the impact of regional culture on the development trajectory of these districts (Saxenian, 1994; Storper and Scott, 1995) as well as the evolutionary aspects of high-technology districts (Storper 1993). Saxenian (1994) in particular has noted the important role of regional culture in fostering innovation and entrepreneurship, which help industrial districts evolve over time. Unfortunately, these cultural and institutional aspects of regions are ignored in economic development initiatives, which all too often employ urban growth machine tactics such as industrial recruitment, tax incentives and lower regulatory barriers to overcome regional deficiencies and promote economic growth (Molotch, 1976). Present work on EE also suffers from this myopia because most studies focus on the documentation of components without considering the evolutionary nature of these components.

To address this issue, the objective of the present study is to develop an evolutionary framework of EE development that integrates important components from prior work and describes how critical elements of an entrepreneurial system interact and evolve over time. This perspective is necessary because as EE evolve, the importance and relative strength of components changes, as do the policies necessary to sustain these systems over time. The framework will be applied to the Phoenix, Arizona EE to understand its evolutionary dynamics from the 1940s forward using archival data and

content from over 100 semi-structured interviews of entrepreneurs and stakeholders. This profile will focus on obtaining a broad perspective on the Phoenix EE from 2000 forward to highlight how the dynamics of this EE impact entrepreneurial activity across a multitude of industrial sectors. Phoenix makes for an interesting case study because it contains a growing entrepreneurial presence. It is also known for its growth machine economic development strategies (Shermer, 2013), which this case study will highlight, have a limiting impact on EE development.

The profile of Phoenix using this framework unpacks current components, which suggest an EE in the birth phase. It is also able to diagnose next steps to helping the EE grow and reach the next phase of development. From a broader perspective, this study is valuable because it reveals that attempts to naturalise urban and regional economic processes (Feld, 2012), do not exempt EE from the cultural and institutional context in which they operate, which are subject to regional politics and the power relations of urban growth machines (Molotch, 1976). Thus, it is necessary to work within the cultural and institutional context of places to foster more grassroots development approaches in order to develop important aspects of EE that cannot be formally managed, such as local networks of entrepreneurs and mentors, and a regional culture that is tolerant and conducive to the creation of entrepreneurial ventures.

Overview of EE

While prior work on high-technology districts (Storper, 1993; Storper and Scott, 1995), has highlighted the importance of relational assets in regional economies, a focus on new business creation and the environment in which new businesses are created – essentially the entrepreneurial

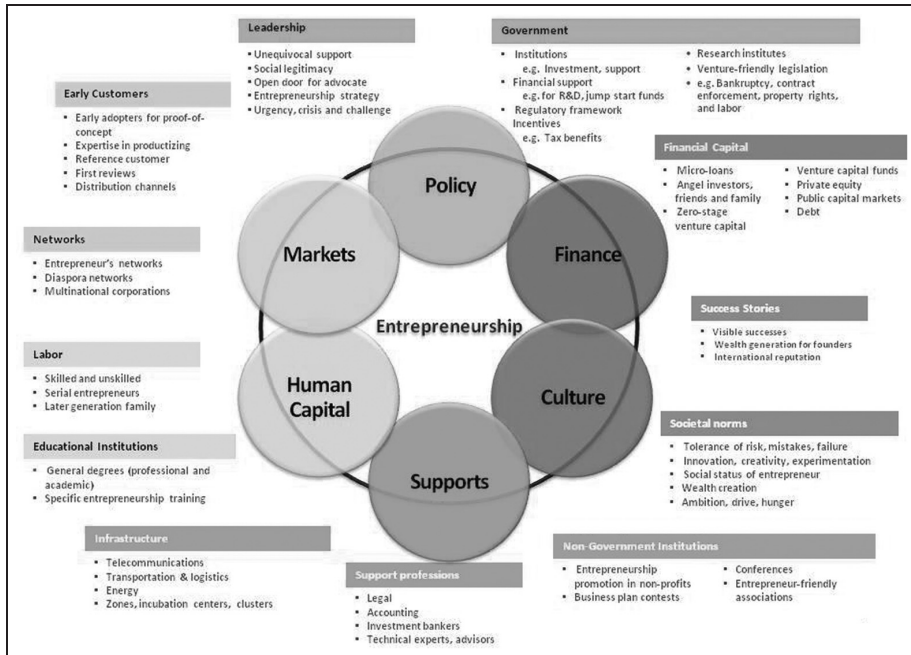


Figure 1. Domains of the entrepreneurship ecosystem.
Source: Isenberg (2011).

ecosystem perspective – has been missing. New business creation does not only depend on the relational aspects of an economy, but also on issues related to market development, human capital, finance, culture, support, etc. In this regard, work that takes a systems approach to understanding factors that impact new ventures is a related but important step forward. EE are defined as the interacting components of entrepreneurial systems, which foster new firm creation in a specific regional context (Neck et al., 2004). Hubs of entrepreneurial activity are present in a variety of locales across the globe. Examples that have been studied include Boulder, Colorado (Feld, 2012), the Copenhagen pharmaceuticals cluster (Mason and Brown, 2014), Oxford, UK (Lawton-Smith et al., 2008; Mason and Brown, 2014), and Silicon Valley (Saxenian, 1994). Owing to the uniqueness of EE, prior work is dedicated to understanding the key

components and actors within these systems (Bahrami and Evans, 1995; Cohen, 2006; Feld, 2012; Isenberg, 2010, 2011). Isenberg (2011) highlights six domains within EE (human capital, markets, policy, finance, culture and supports) that contain 12 core components. Figure 1 provides more detail about these six domains and corresponding components (Isenberg, 2011).

Although it is important to distinguish important elements of EE, these documentation efforts tend to be prescriptive and retrospective in nature. They also tend to focus on the components of successful EE rather than all EE more generally. To date then, work has not assessed four critical aspects of EE. First, current approaches provide static analyses that do not give information about the initiation and the processes behind the present-day state of EE (Mason and Brown, 2014). Second, there is a complete neglect of the institutional and political context in

which EE evolve and therefore attention to the influence of the sociopolitical context on EE evolution seems to be important. Third, work does not highlight the consequences of missing elements or deficiencies in the interactions between components within these systems. Fourth, there is limited discussion of the role of regional policy in acquiring missing elements and facilitating interaction between EE elements.

An evolutionary perspective on EE

While the field of economic geography has started to conceptualise evolutionary dynamics particularly regarding industry clusters (Menzel and Fornahl, 2009), there is a gap in our understanding of the evolution of systems that thrive because of the birth and death of entrepreneurial ventures and their surrounding support infrastructure. Mason and Brown (2014) discuss a point in EE development where spinoffs gather enough momentum to become a self-reinforcing process. Figure 2 presents an evolutionary perspective on an EE. It contains four stages and six core elements as indicated in the domains of Isenberg's framework (Figure 1). Through such an evolutionary perspective it is possible to evaluate the relative importance of Isenberg's six core domains across the four stages of EE development.

The first stage in the framework is the birth phase, which is characterised by more firm births than firm deaths. Although firm births are low, there are also few firm exits or deaths, which means that the overall number of firms slowly increases as entrepreneurs take risks and start new companies. Many of the core components of EE are also underdeveloped at this time. Underdeveloped elements include markets for entrepreneurs because existing firms do not yet function as customers or incubators for entrepreneurial firms. There are few success stories because

there are few firm births and the regional culture is not risk-oriented and conducive to new ventures. Financial capital is not yet expansive, but it is emerging and becoming slowly available as investors become risk-oriented. At this stage, specific entrepreneurship-oriented human capital has not developed because there are few experienced entrepreneurs and educational institutions are oriented towards general degrees. There are also few personalities who stand out in terms of their ventures, as well as their engagement and efforts towards building an entrepreneurship-oriented support infrastructure. In this phase, a support infrastructure emerges as pioneering institutions such as non-profits and incubators are founded. Finally regional economic development policy remains oriented towards traditional economic development strategies such as firm attraction and retention, real-estate and cluster development.

The next stage is the growth phase where each element in the EE framework starts to become more specialised and targeted towards entrepreneurship. This benefits the founding of new firms and firm births exceed firm deaths. During this phase, markets evolve to include regional but also national and international opportunities. In this phase the first serial entrepreneurs become visible and educational institutions start to offer entrepreneurship-specific programmes. Thus, human capital becomes more entrepreneurially minded and successful entrepreneurs begin to function as role models for potential nascent entrepreneurs. As a result of this increasing dynamic, financial capital becomes more readily available and easier to access as investors develop trust in the evolving EE. The regional culture strengthens and entrepreneurial networks expand and become denser. As a result, societal norms may change in favour of entrepreneurship. The support infrastructure, as well as the region's economic development policy, start

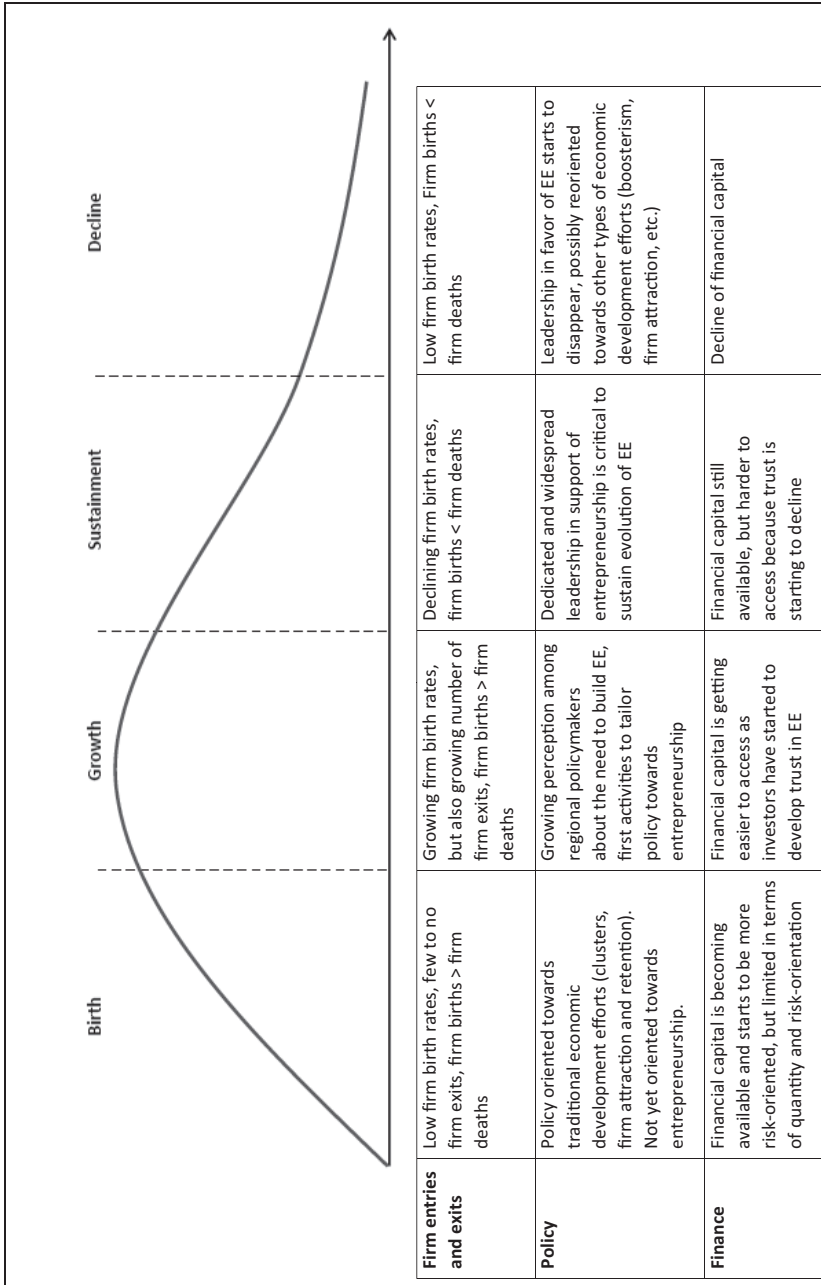


Figure 2. Evolution of an EE.

Culture	Few success stories, tolerance of risk and failures not yet developed, few personalities who stand out as entrepreneurs	Networks among entrepreneurs in the region become important as entrepreneurs are better known; societal norms may change in favor of EE	Success stories become critical as firm deaths are starting to increase	Entrepreneurial culture starts to decline in terms of both success stories and favorable societal norms
Support	Emergence of pioneering support organizations such as incubators, nonprofit groups, entrepreneurship-oriented infrastructure etc	Non-governmental institutions in support of entrepreneurship start to become more specialized and targeted towards new firm creation	Non-governmental institutions start to diversify, possibly away from EE support	Loss of support through non-governmental institutions
Human Capital	Educational institutions mostly oriented towards general degrees, no serial entrepreneurs	EE starts to see first serial entrepreneurs, educational institutions start offering specific entrepreneurship training programs	Decline of serial entrepreneurship	Entrepreneurship is not seen as a career option anymore
Markets	Markets for entrepreneurs not yet developed; Firms - often large firms - in the region do not function as incubators nor are they customers for regional entrepreneurial firms	Market opportunities for entrepreneurs in the region develop, also start to see national and international market opportunities	Market opportunities decline (regionally, nationally and internationally), networks start to decline	Market connections and networks disappear
Policy Implications	Lowering the hurdles for entrepreneurship, networking existing and nascent entrepreneurs, building an entrepreneurship-friendly support infrastructure	Expansion of firm births through support in terms of financial capital, but also networking oppts, etc. important	Strengthening of networks: particularly diaspora and multinational networks	Avoid lock-in of EE through e.g. infusion of new ideas, connections to other entrepreneurial ecosystems nationally and internationally

Figure 2. (Continued)

to become more specialised and targeted towards new firm creation.

After the growth phase, the EE reaches the sustainment phase, which is characterised by a smaller number of firm births and a larger number of firm deaths. In this phase, market opportunities and networks start to weaken. There is also a general decline in the number of new ventures, and a severe decline in the number of serial entrepreneurs as the opportunity cost of self-employment rises and entrepreneurs trade self-employment for other types of employment. Investor confidence begins to wane and financial capital becomes harder to access. Support infrastructure changes as well and programmes that were targeted towards entrepreneurship support start to diversify into other realms. During this phase, dedicated leadership and entrepreneurship-specific policies are critical to sustaining new venture creation. Success stories also become critical as firm deaths start to rise.

If EE actors are not successful in extending the sustainment phase, the EE will start to decline. In this final phase, firm deaths are significantly greater than firm births. Market connections and networks disappear. Entrepreneurship is no longer perceived as a viable career option. Financial capital declines and becomes unavailable. There is a general decline in entrepreneurship support and policies in favour of new venture creation. As a result, the regional culture is not conducive to entrepreneurship and the EE either disappears or begins the cycle anew.

Data and methods

Phoenix was selected as a case to demonstrate the utility of this evolutionary framework because it is a metropolitan region with some entrepreneurial presence, and a top-down, boosterism approach to economic development (Abbott, 1981; Gober, 2005; Shermer, 2013). This represents a stark

contrast to other grassroots EE across the country, such as Boulder, Colorado (Feld, 2012). As this study will show, this approach to development has an impact on the development trajectory of EE. While a boosterism approach may be an effective strategy for assembling some components of EE, it is not capable of fostering growth in grassroots components such as entrepreneurial and financial networks, the availability of mentors and the presence of success stories.

Data

Both archival data and semi-structured interviews are used to better understand the evolutionary dynamics of the EE in Phoenix. To account for evolutionary dynamics, the semi-structured interviews were conducted at two points in time. The first set of interviews was conducted between 21 May and 25 May 2007. Individuals that were interviewed in this time interval include economic development officials from the City of Scottsdale and the Greater Phoenix Economic Council (GPEC, 2014), as well as executives from venture capital and local area technology companies. These 23 interviews are used to present information about the building blocks of the EE from a historical perspective. The 2007 interviews are key to documenting the process of firm building in the metropolitan area with a focus on the biotech and life sciences industries. This was important to evaluate and to understand how major firms in the area such as Motorola, Intel and General Dynamics influenced the labour pool, entrepreneurial activity and innovative activity. It also sought to establish how the defense and semiconductor industries as well as the life sciences industry influenced education, tax policy and other important aspects of the public policy sphere in Phoenix. A second focus of these interviews was the interviewee's perception of the Phoenix

entrepreneurial ecosystem and the influence of policies and initiatives on high-tech and life sciences startups. The third and final aspect of these interviews was the documentation of critical elements in the formation process of the regional innovation and entrepreneurial systems. This was essential to document innovative and entrepreneurial efforts at this moment in time given the series of events that transpired and that likely had wide-reaching impacts on the EE in the early 2000s.

The second series of 122 semi-structured interviews were conducted between January of 2013 and January of 2014. These interviews aimed to gain a general perspective on the Phoenix EE rather than the perspective of one industry in particular or even of specific groups of firms. The list of people interviewed included managers of business incubation facilities, entrepreneurs located in incubation facilities and entrepreneurs not located in metro area incubation facilities. Interviews were also conducted with key stakeholders in the metropolitan area, as identified by archival research and interview participants. Two of the inductive themes that came out of several of these interviews were the history of and perceptions of the Phoenix EE. These interviews are valuable because they provide both a retrospective and prospective view on the development of the system over the last decade. They also suggest that the legacy of growth machine economic development tactics is insufficient to acquire and integrate documented components of vibrant EE.

Historical perspective of the Phoenix EE

Phoenix is a former agricultural and mining region (Glasmeier, 1988; Shermer, 2013) whose economic and industrial transformation took off in the 1940s with a large number of branch plant relocations to the area.

A group of influential business elite that included lawyers, retailers, bankers and newsmen initiated this economic transformation by pursuing industrial recruitment development strategies to create a favourable business climate through liberal regulations, low taxes and subsidies for corporations (Shermer, 2013). Between 1948 and 1964, more than 700 firms relocated or opened in the metropolitan area and manufacturing replaced agriculture as the second leading industry in terms of employment (Shermer, 2013: 225). By the 1970s, the Phoenix economy had begun to attract high-technology companies such as Honeywell, GTE Microcircuits, ITT-Cannon, Intel and Sperry. While these branch plants created numerous production jobs, they 'failed to stimulate the development of an integrated entrepreneurial high tech economy' (Glasmeier, 1988: 291). Firms such as Motorola, but later Intel (which established a production plant in 1979 in Chandler, Arizona) also did not contribute to the creation of spinoff firms.

During the late 1980s and early 1990s, economic development leaders in Phoenix started to reorient their initiatives and programmes towards a more cluster-based economic development approach (Waits, 2000) to diversify the economy away from traditional sectors towards a more knowledge-based economy (MB interview 24 May 2007; SW interview 24 May 2007). At this time the need to diversify the economy gained urgency as large firms such as Motorola, Honeywell or Intel either scaled back their operations or divested business units (MB interview 24 May 2007; SS interview 5 June 2007). These efforts involved the formation of various groups, including a coalition of public and private organisations charged with economic development (the ASPED Coalition), industry cluster advisory groups (such as the aerospace or the biomedical cluster groups), as well as foundation

working groups. The cluster efforts were not oriented towards fostering innovation and entrepreneurship (SW interview 24 May 2007) but greater collaboration among cluster members. For example, the biomedical cluster in Phoenix worked to bring the hospitals and the medical device companies in the same room, yet with limited success because many of these organisations and firms did not have much in common (SW interview 24 May 2007). Of the cluster-based organisations initiated in the 1980s and 1990s, only a few remained by the mid-2000s such as the nanotechnology cluster in Phoenix and the optics cluster in Tucson (RH interview 24 May 2007).

At the turn of the century, several changes took place within the metropolitan area that would strengthen higher education institutions in the area, as well as government-based efforts to support research. From the 1940s until this point, the emphasis of university–industry relationships focused on creating talent for high-tech firms in the area (JF interview 24 May 2007; RH interview 24 May 2007; JK interview 24 May 2007). Arizona State University (ASU) also played a relatively minor role in fostering entrepreneurial activity. This changed with the arrival of a new ASU president in 2002 (LC interview 26 June 2007). In this year, Michael Crow, a former professor of science and technology policy at Columbia's School of International and Public Affairs succeeded Lattie Coor. As ASU president, Crow started to redefine the university's role not only in the Phoenix metropolitan region, but also nationally. Through his efforts, ASU opened a downtown campus in 2006, which added several buildings to the downtown areas. Several new research institutes in fields where the region's leaders hoped to influence the Phoenix economy (e.g. sustainability and biosciences) opened around this time. An example is the founding of the ASU Biodesign Institute in 2003.

In terms of government-based efforts to support research, three major milestones characterise the first decade of the 21st century. In 2001, the Flinn Foundation published its Arizona Bioscience Roadmap, in which it sketched the plans to establish a new type of industry. A second, related milestone occurred in 2002 with the establishment of the Translational Genomics Research Institute (TGen) in downtown Phoenix (MB interview 25 May 2007). Founded by an Arizona native, Jeffrey Trent, who had served for 10 years as the Scientific Director of the National Human Genome Research Institute at the National Institutes of Health in Bethesda, Maryland, this institute involved collaboration by then-Governor Jane Hull to assemble a broad group of visionary leaders (including the CEOs, hospitals, foundations and the Native American community) that raised about US\$90 million to attract and help set up TGen in Phoenix. A third milestone during this phase was the creation of the Science Foundation Arizona (SFAZ) in 2006. Modelled after the Science Foundation in Ireland, SFAZ was created by a group of influential business leaders to foster collaborations between universities and industry.

At the end of the first decade of the new millennium then, Phoenix had made important strides in developing some important prerequisites for an entrepreneurial ecosystem such as cluster-based policy efforts, strengthening of higher education institutions primarily with regard to labour and government efforts to support research. While important, these components did not yet represent the birth of an EE because several critical ingredients were missing at this time, including spinoff companies from technology branch plants (MB interview 24 May 2007; BB interview 21 May 2007; BBr interview 25 May 2007; SJ interview 21 May 2007; JK interview 24 May 2007; MM interview 22 May 2007), a labour pool with

management experience that had the skills to become entrepreneurs and/or serve as mentors for local area startups, and venture capital remained difficult to access (CL interview 24 May 2007). Thus, at this time there was still a perceived gap and need for the building of a more conducive entrepreneurial milieu (BB interview 21 May 2007; MH interview 23 May 2007).

Current perspective of the Phoenix EE

Almost a decade later, interviews with incubation facility managers and entrepreneurs in 2013, and the early portion of 2014, reveal an EE in the birth phase of development (see Figure 2 for a theoretical description of the birth phase). The general consensus of the interviews conducted between 2013 and 2014 is that progress has been made in the development of the EE. One entrepreneur noted that downtown Phoenix had experienced tremendous changes in the last 10 to 15 years and they wanted to be a part of the revitalisation that was happening (JI interview 12 July 2013). Incubator managers indicated similar sentiments and highlighted that Phoenix is on the move in terms of its entrepreneurial ecosystem development (JC interview 14 August 2013; KM interview 11 January 2013).

Interviews also revealed that these development efforts are being driven by government programmes, incubation facilities and university-based programmes. As of this time, there is evidence of support organisations such as non-profit groups and incubators. However, economic development policy remains oriented towards traditional strategies such as clusters and firm attraction and retention. The educational institutions in the area remain oriented toward standard degree programmes and there are few visible serial entrepreneurs and success stories in the region. Although financial capital is

becoming available, it is limited because of the conservative nature of investor attitudes, particularly regarding technology ventures, and the amount of financial support provided to entrepreneurs. Markets for entrepreneurs are also underdeveloped and the large firms in the region do not train their workers in skills conducive to future entrepreneurial pursuits, nor do they serve as customers for new firms that have started in the region.

Government

At this time, the government support offered is oriented towards classic growth machine strategies including image marketing, cost advantages and low regulatory hurdles. Interviewed entrepreneurs perceive the area to be a place that appears open to new ventures and lacks red tape, which makes the startup process easier (MS interview 16 August 2013). Downtown revitalisation efforts such as the construction of the downtown ASU campus in 2006 and the Downtown Phoenix Inc., which is a community development group created in 2013 to further downtown revitalisation efforts, have also appeared to improve the image of the area. This suggests that policy in the form of government support is positively influencing the entrepreneurial. Several entrepreneurs also noted that there are people who have moved from other parts of the country and find Phoenix a great place to start a business from a cost perspective (SK interview 4 October 2013). The following quote highlights this sentiment (SK interview 4 October 2013):

And there's an incredible task structure that's very advantageous to do so, versus some of our competitor places like California, where it is very difficult to start a business and have quite a, cumbersome process to get going and a very heavy tax structure. So it's nicer here, so at least we have those things going for us.

We also, I believe that in this state that we have a pretty natural disaster free area, which is something a lot of business, like these data centers and Intel and you know, fabrication facilities, medical research facilities, that will probably take into consideration pretty heavily. They don't want to be where an earthquake is going to be, and all those facilities, they don't want to be where there's going to be landslides or you know, excessive flooding or some other things, we don't have any of that. So it's kinda nice, there are no tornados here.

Support infrastructure

An evaluation of business incubation facilities in the Phoenix metropolitan area highlights a growing support infrastructure for entrepreneurs. Based on incubation facility lists obtained from the National Business Incubation Association (NBIA) and the Arizona Commerce Authority (AZCA), in 2013, there were more than 52 incubation facilities in the state of Arizona. In Phoenix, there were 22 facilities in operation at the time the interviews were conducted. Of these incubation facilities, the oldest space began operations in 1998. Most facilities have opened since 2008 with an even larger percentage opening in 2010 or later. The interviews with managers reveal a variety of reasons behind facility openings. While some of the facility managers discussed a general desire to help community entrepreneurs (CKJ interview 29 March 2013; JS interview 8 February 2013) two of the managers revealed that the recession was a reason for their facility openings (JN interview 5 March 2013; KM interview 5 February 2013). Other managers expressed a desire to contribute to the development of downtown Phoenix (WR interview 8 March 2013; JP interview 29 March 2013). Interestingly, one of the managers mentioned that their facility opened to give entrepreneurs a space to operate so they

would not migrate to California (MA interview 5 February 2013). Another facility opened in response to an impact study done by the city of Peoria, which identified unexploited opportunities in medical device development that would leverage the aging population and growing medical community in the area (KN interview 21 March 2013).

While there does appear to be a large presence of incubation facilities, there is fragmentation to the entrepreneurial assistance provided by these facilities (MW interview 4 February 2013; MA interview 5 February 2013; DS interview 10 July 2013). At this stage, there is a relative lack of awareness and networking amongst these actors in the EE. One facility manager interview highlighted a siloed, go-it alone strategy taken by many of these facilities. This siloed approach to assistance results in duplicated efforts, an example of which is multiple entities in Phoenix working on startup weekends (CKJ interview 29 March 2013).¹ This information from the interviews suggests that this form of entrepreneurial support needs to be strengthened through better coordination efforts, which might also help improve entrepreneur networks, which are absent from the EE at this point in time.

Missing elements

While the interviews highlighted a strengthening of government policies and support infrastructure, there are several missing or underdeveloped elements. Attention to these underdeveloped and missing elements is needed to move the Phoenix EE from the birth phase to the growth phase. Specifically, grassroots efforts are needed to cultivate local entrepreneurial networks, which would also create a regional culture that is risk-tolerant and supportive of new ventures. Non-government support and policy efforts also need to be oriented towards entrepreneurship with the goal of creating regional

market opportunities for entrepreneurs, as well as national and international opportunities. Support and policy efforts should also focus on greater coordination amongst EE components and actors.

Markets: Networks. The interviews highlighted that the Phoenix EE is characterised by fragmentation in its institutional capacity to connect entrepreneurs and industry experts. These issues include a lack of mentorship and other difficulties associated with starting companies in Phoenix. One entrepreneur in particular mentioned issues with finding mentors for startups in the web/Internet arenas (MW interview 4 February 2013):

They [incubators] don't have the means, they don't have the right mentors, they don't have them specifically for like web-based stuff, we have a bunch of engineers that don't know what the Internet is, so there's a big knowledge gap with that and they don't push – they are more like social events than they are let's get to business and like build the company and I have purposely stayed away from them.

Other comments made by entrepreneurs highlight networking issues in the EE, particularly in the regional technology base. These comments indicated the presence of 'invisible networks' in which people could participate if purposeful efforts were made. One interviewee mentioned that there was a solid technology base available to local area entrepreneurs, it was just less visible than one might expect, and one had to plug themselves into it intentionally (JO interview 2 August 2013).

Financial capital. While financial support remains scarce, the interviewees highlighted that progress has been made in providing funding for new ventures. Some entrepreneurs highlighted the availability of money

in the form of real-estate funds and people who want to invest in local companies (TA interview 5 September 2013) while others highlighted difficulties in obtaining sufficient capital for their ventures (XK interview 2 October 2013; BS interview 11 January 2013; JM interview 23 August 2013; FG interview, 4 March 2013). Some of the issues cited by entrepreneurs were related to the source of funds in the form of real-estate money and the entrepreneurial reputation of Arizona compared with other places. For example, although there is a lot of real-estate money, entrepreneurs felt that real-estate investors did not understand the intricacies of investing in startup companies (BS interview 11 January 2013; JM interview 23 August 2013). Another issue mentioned by one entrepreneur was the difficulty in obtaining venture funding compared with California companies because of a perception that Arizona companies are comparatively less experienced than their California counterparts (XK interview 2 October 2013). A need for more early-stage support for entrepreneurs was also mentioned (FG interview, 4 March 2013).

Culture: Success stories. Another critical element of successful EE is the presence of success stories in the form of visible successes, or ventures that have served as wealth generators for founders and the construction of an international reputation (Isenberg, 2011). Based on the interview data, these components of success stories appear to be missing in Phoenix. People highlighted that the EE suffers from a lack of entrepreneurial recycling (Mason and Harrison, 2006) because it does not have many startups with successful exits (BRob interview, 9 August 2013). This means that there is a lack of people in the area that can provide capital, resources, and expertise in the form of mentorship to local area entrepreneurs (BRob interview, 9 August 2013).

A related and particularly interesting theme that came out of the interviews with entrepreneurs is the notion of a tier structure to EE, which is something addressed in Mayer (2011). Related work on high-technology districts also suggests a hierarchy or tiering of regions around the globe that contains a few successful regions at the top, with a much larger number of regions in an underdeveloped state at the bottom (Storper and Scott, 1995). This 'tiering' or reputational effect associated with the EE may be impacting entrepreneurial recycling and the amount of success stories that stay in the area. One entrepreneur commented that Phoenix is a fragmented, third-tier market for entrepreneurs (SSch interview 27 September 2013). Other entrepreneurs commented that they started their business in Phoenix but planned to move elsewhere (JI interview 12 July 2013; SSan interview 21 June 2013). One of these same entrepreneurs commented that they wanted to 'conquer Phoenix first and then move somewhere else' (JI interview 12 July 2013). Thus, there appears to be a perception that Phoenix is a training ground for entrepreneurs, but to really be successful entrepreneurs need to relocate to one of the more traditional hotbeds of entrepreneurial activity (i.e. Boulder or Austin).

Discussion and conclusion

This evolutionary profile of the EE in Phoenix highlighted a boosterism approach that was successful in acquiring some components of successful EE. At this time however, the Phoenix EE remains in the birth phase because it has not yet acquired essential components of EE that would propel it into the growth phase. These missing components include local success stories, dense networks of local entrepreneurs and mentors. The acquisition of these core elements is critical to increasing the number of firm births

in the region, which is one of the defining characteristics of EE in the growth phase. The development of these elements will likely require a blend of more grassroots strategies with current top-down approaches. Such an approach would follow the recommendations of prior work on EE, which suggest a blend of top-down and bottom-up approaches (Mason and Brown, 2014).

To progress to the growth phase, the Phoenix EE will need to work on helping entrepreneurs gain easier access to financial capital. There is real-estate money in the area, and strategies to help train real-estate investors in financing startups may be a way of funnelling this money to new ventures (BS interview 11 January 2013). Aside from the finance piece, more work is necessary to foster networks between local entrepreneurs. This may be a role for the variety of incubation facilities and educational institutions in the area. To date, incubation facility managers have highlighted fragmentation in networking efforts so better coordination between these facilities may be a way of cultivating local entrepreneurial networks. In this regard, policymakers may be able to serve in a coordination capacity to facilitate interactions between entrepreneurs. They might also be able to identify and grow a mentor network to help entrepreneurs who are not located in incubation facilities across the valley. In terms of success stories, policymakers and economic development entities might think of creative ways to profile successful entrepreneurs in the metropolitan area to highlight that success is possible in Phoenix.

This profile of success stories would add a much-needed component to the EE besides those associated with classic urban growth machine aspects of the area such as low taxes and regulatory hurdles. While it is unlikely that Phoenix and other lower-tier ecosystems will ever be able to compete with first-tier ecosystems such as Silicon Valley, who have

had a first-mover advantage in EE development, which is positively reinforced by a degree of path dependence over time and strong university connections, vibrant venture capital markets and a highly developed knowledge infrastructure; this case study suggests advantages that lower-tier EE can offer entrepreneurs. In fact, an advantage for entrepreneurs in lower-tier ecosystems, such as Phoenix, is that they are likely to receive more attention to help nurture their fledgling ventures than in hyper-competitive first-tier EE such as Silicon Valley or Austin. The metropolitan area provides a lower-stress environment with few competitors for entrepreneurs to work through some of the initial hurdles associated with starting a new venture. Entrepreneurs are also more likely to have greater latitude in the types of ventures started than in other metropolitan areas where specific types of ventures are expected (i.e. high-technology). Based on these potential advantages, Phoenix policymakers need to encourage nascent entrepreneurship by communicating the nurturing nature of the EE to potential entrepreneurs inside and outside the region. This could be done via marketing campaigns and the networking events targeted at local area entrepreneurs described above. They could also create incentives for local area employers to provide on the job training (management, accounting, finance) so that employees that decide to start their own business in later years are more likely to be successful.

Aside from the identification of gaps in the Phoenix EE and potential solutions for filling these gaps, the evolutionary framework developed in this study provides useful benchmarks for determining the stage of development of an EE. As the conceptual model highlighted, at each stage of this framework different EE elements are more important than others. In the beginning phases of an EE, key factors such as market

opportunities, human and financial capital and culture are important. During later stages of development, the EE requires more refined support infrastructure and specialised policies. As EE dynamics decline, impulses for reinvigoration are necessary and a new evolutionary cycle may emerge. This evolutionary perspective provides stakeholders with action points to help maintain or propel an EE to the next level. This is a distinct improvement over previous static approaches that provided a list of ingredients with no sense of their relative importance over time.

The evolutionary perspective is valuable because it provides a sense of how history, culture and the institutional setting impact EE. It is also valuable given the uniqueness of EE around the globe and provides a framework for comparing these diverse EE. That said, more work is needed to understand the evolution and performance of EE over time in a comparative context. Given this need, future work could use the framework developed in this study to evaluate whether the apparent tier structure of EE (Mayer, 2011) speaks to the strength of particular elements in the framework in higher tier EE. Future work could also use this framework to compare and contrast the evolutionary trajectory of EE in similar tiers, which could be useful in understanding why particular types of places remain trapped in a specific phase. While there are undoubtedly clear components of successful EEs, it is misleading to interpret these components as a recipe for creating successful EE. Instead, the evolutionary perspective of this study provides a way of incorporating important components of EE within a dynamic framework that can be used in a case specific or comparative context to better understand an increasingly important component of vibrant, competitive regions.

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Note

1. Startup weekends are new to Phoenix. The first startup weekend EDU was held on 25 April 2014 (Baldo, 2014).

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