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*University-Centered Entrepreneurial
Ecosystems: A Conceptual Framework*

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University-Centered Entrepreneurial Ecosystems: A Conceptual Framework

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Abstract

Research on entrepreneurial ecosystems has advanced considerably over recent years and has become a popular topic among policy makers. Despite the interest, research on the topic has focused overly on entrepreneurial ecosystems in large cities in the United States (US). Ecosystems in other contexts, such as, small cities, underpopulated rural areas and university towns have not been considered in much depth, nor has there been much focus on regional contexts outside of the US. This paper begins to address this deficit by reviewing three groups of literature. From the review conducted the paper builds a conceptual framework to consider entrepreneurial ecosystems led by universities. First, the paper considers the literature on entrepreneurial ecosystems and it explores its implications for understanding the concept in small towns. Next, the paper considers the literature on entrepreneurial universities and explores how it informs our understanding of the role of universities in regional innovation. Then the paper incorporates current thinking on entrepreneurship education to consider how education and learning practices help build and grow such ecosystems. The paper concludes by drawing together these literatures into a conceptual framework outlining the structure, components and mechanisms that enable universities to operate as catalysts in the creation of entrepreneurial ecosystems in smaller cities. The paper makes a contribution by drawing disparate ideas across several domains together into a set of concepts that can be tested empirically and can be used practically to guide efforts to enhance regional entrepreneurship and innovation.

Key Words

Entrepreneurship Ecosystem

Entrepreneurial University

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Higher Education

Word Length

[Add]

University-Centered Entrepreneurial Ecosystems: A Conceptual Framework

Introduction

The concept of entrepreneurship ecosystems has gained momentum in recent years within the academy and amongst policy makers (World Economic Forum, 2013). The concept of regional based innovation systems and innovation clusters is, however, not a new one (Van de Ven, 1993a). Its reemergence and growth in the domain is linked to greater awareness in entrepreneurship research that context matters and that regional institutions play an important role in the development of entrepreneurial ventures (Autio et al., 2014). Despite the increased interest in entrepreneurship ecosystems there are many acknowledged deficits in the subject. It has been criticized for being poorly defined and the concept, being attractive to many stakeholders including entrepreneurs and government agencies, has been misused; as far as some are concerned (Roundy, 2016). The subject has also been criticized for simply listing attributes of ecosystems without considering causation (Stam, 2015; Mack and Mayer, 2016) and research has struggled to agree on the geographic boundaries of ecosystems and consider the temporal processes involved (Spigel, 2015). Prior studies have typically focused on historic reviews of successful entrepreneurial ecosystems, which has its limitations (Feldman and Zoller, 2012), and have been dominated by work considering ecosystems in large US cities (Roundy, 2017). It is the purpose of this paper to begin to address a number of these issues by exploring entrepreneurial ecosystems in small cities, where by necessity, a university is the lead player. We are interested in the role of universities in entrepreneurial ecosystems, how they can assist the formation of an ecosystem, enable long-term growth in the ecosystem and ultimately thereby contribute to regional economic development (Miller and Acs, 2017). The role of universities is a

moot subject in the entrepreneurial ecosystem literature. Some authors ascribe important roles to universities as catalysts in the initial formation and expansion of ecosystems (Neck et al., 2004), while others identify a more peripheral role as enablers and suppliers of intellectual capital and human resources (Feld, 2012). Consequently, it is unclear what role universities can play and how they might best position themselves to be catalysts in their regions. Our paper, therefore, has some critical questions. First and foremost we ask, what is an entrepreneurial ecosystem and how can a university help build one in a restrained institutional context, such as, a small city? Alongside this question we ask how can a university become entrepreneurial in the context of helping build its local ecosystem? And finally, what educational and learning frameworks can be put in place at an operational level to enable a university to contribute to the establishment of an ecosystem? To answer these questions this paper engages in a detailed literature review and constructs a conceptual framework for future empirical testing. The first part of the paper takes a deep dive into the current literature on entrepreneurial ecosystems. Here we seek to explain what ecosystems are, how they can be built and we aim to explore the part a university can play in building one, particularly where the institutional context is constrained and local resources are highly limited. In the second part of the paper we consider the literature on entrepreneurial universities and explain how thinking about entrepreneurial universities in a general sense can assist in designing the university of the future, in such a way, that it enhances regional entrepreneurial ecosystems. Finally, we build from these disconnected literatures a conceptual framework that can be tested empirically and applied practically. Ultimately, the purpose of the paper is to help universities understand their contextual role and further synthesize knowledge in such a way that we can enhance entrepreneurial endeavor led by universities that are located in challenging regional contexts (e.g. in small cities and rural locations).

Entrepreneurship Ecosystems

Though a relatively new term the concept of an entrepreneurial ecosystem is not new. It has its roots in clusters of innovation (Engel, 2015) and regional innovation systems (Van de Ven, 1993b). As a topic of interest amongst researchers it has also grown quickly in recent years (Borissenko and Boschma, 2017). The idea that a region or specific location could become a ‘hotbed’ of entrepreneurial activity and, the idea that specific contextual and institutional factors could lead this to occur, has deep roots (Feldman, 2001). Van de Ven (1993b), for example, points towards ecological thinking about populations of entrepreneurial ventures, the examination of firm births and deaths, and research on the role of evolutionary variation as a possible root to thinking in the subject (Aldrich, 1979; Hannan and Freeman, 1977). Feldman (2001) considers the starting point to be the role of regional innovation systems thinking and prior work on geographically defined clusters as the starting point, for example, she highlights that Marshall (1890) first noted the tendency of firms to cluster spatially and considers Porter’s (1990) work on clusters, as well as, Florida and Kenny’s (1988) work on the social structure of innovation. Pitelis (2012) highlights the role of clusters but also links work back to thinking on industrial districts (Becattini, 1978; Brusco, 1982; 1986).

There is consequently some variation in the definition of entrepreneurial ecosystems. There is an “eco” part, in the sense that the concept uses an analogy drawn from biology. This part suggests that the fate of individual ventures may somehow be tied to the conditions in their environment (Florida and Kenny, 1988). There is a ‘systems’ part that suggests the environment is a complex system of interwoven and adaptive components that is dynamic and constantly changing (Stam, 2015). There is an ‘entrepreneurial’ part, which is variously defined but often

includes to differing degrees, ‘high growth ventures’, ‘small businesses’ (Roundy, 2016) and ‘technology-based ventures’ (Baumol, 1990). While there is some debate it seems generally acknowledged that ‘entrepreneurial’ in this context implies ‘high added value ventures’ and not traditional small businesses and/or self-employment (Stam, 2015). A number of useful definitions can be highlighted from the prior literature:

On clusters, “*Clusters are geographical agglomerations of firms in particular, related, and/or complementary, activities, sharing common vision, and exhibiting horizontal, vertical intra- and/or inter-sectoral linkages, embedded in a supportive socio-institutional setting, and cooperating and competing in national and international markets*” (Pitelis, 2012: 1361).

On innovation clusters, “*are global economic hot spots where new technologies germinate at an astounding rate and where pools of capital, expertise, and talent foster the development of new industries and new ways of doing business*” (Engel, 2015: 37).

On entrepreneurial ecosystems, “*an entrepreneurial ecosystem is best conceptualized as a complex adaptive system which, like a forest ecosystem, is composed of a rich array of inter-relationships*” (Roundy, 2016: 238) and, “*are combinations of social, political, economic and cultural elements within a region that support the development and growth of innovative startups and encourage nascent entrepreneurs and other actors to take risks of starting, funding, and otherwise assisting high-risk ventures*” (Spigel, 2015: 50) or, “*a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory*” (Stam and Spigel, 2016:1).

These definitions show that an ecosystem is not inherently a ‘cluster’ because ventures in an ecosystem do not necessarily share “*complementary activities*” or a “*common vision*” (Pitelis, 2012). Like clusters there is clearly a geographic aspect for most researchers and it is an adaptive system but the focus is on high risk, high growth ventures and/or ventures developing new technologies (Engel, 2015; Spigel, 2015). As well as focusing on networks and inter-relationships entrepreneurial ecosystems are interested in the fabric of the locality, its infrastructure, its culture, and its social relations and how these support entrepreneurial endeavor (Neck et al., 2004; Autio et al., 2014). The concept of an entrepreneurial ecosystem has, however, been applied to specific organizations, such as, large corporations (Zahra and

Nambisan, 2012; Clarysse et al 2014) and universities (Wennberg, Wiklund and Wright, 2011; Siegel and Wright, 2015) and in some of these studies the geographic boundaries of an ecosystem are less tangible.

Much of the literature exploring ecosystems has undertaken historical reviews of locations and/or regions (Neck et al., 2004; Feldman, 2001; Engel, 2015; Harper-Anderson, 2018). From these many attributes have been identified and a number of papers summarize common attributes that seem to apply across ecosystems (Van de Ven, 1993b; Neck et al., 2004; Feldman, Francis and Bercovitz, 2005; Stam, 2015; Engel, 2015; Spigel, 2015; Harper-Anderson, 2018). Despite these summaries the nature of causality remains unclear (Spigel, 2015) as does the inter-connections between attributes in specific cases (Harper-Anderson, 2018). These common attributes are summarized in Figure 1.

[Insert Figure 1]

First and foremost, the prior history of the region is important (Engel, 2015; Harper-Anderson, 2018). Studies have shown that the prior immigration, industrial legacy, and cultural and social history of regions shape their cultural makeup (Feldman, 2001). Such histories make each region unique and each entrepreneurial ecosystem consequently has different historical dynamics that need to be appreciated prior to policy interventions (Engel, 2015). Prior history shapes attitudes towards entrepreneurship and regional cultures that have more supportive cultural attitudes are seen to be more conducive to entrepreneurial activity (Julien, 2007). Attitudes considered conducive include willingness to invest, willingness to take risks and supportive views towards failure (Neck et al., 2004; Feld, 2012). There are also many social and human capital attributes listed in studies. These include availability of talent, which can include access to talented employees, availability of experienced entrepreneurs and ‘dealmakers’

(brokers of key relationships between investors and entrepreneurs), the production of technically skilled new labor and the capacity for labor mobility between entrepreneurial ventures (Feldman and Zoller, 2012). Access to venture finance has also been considered a critical component, though there is debate over causality (Feldman, Francis and Bercovitz, 2005). Venture finance itself is complex within the context of ecosystems and can include the willingness of friends and family to invest, the availability of seed grants and seed capital, access to informal and formal business angel funds and the ability to raise venture capital (Spigel, 2015). Further social attributes include the quality of local networks and their openness and the availability of mentors and role models (Malecki, 1997; Kenney and Patton, 2005).

There are also material needs identified by many of the studies. These include the availability of state-run programs that support entrepreneurship directly and indirectly and an attractive regulatory environment (Isenberg, 2010). Universities are seen to be important for their basic research, intellectual property spillovers, their student and academic entrepreneurs and for their production of talented employees (Audretsch et al., 2011). Professional service firms and other support services that have experience working with entrepreneurs, such as accelerators and incubators, are viewed to assist the formation, launch and growth of ventures when compared to their more conservative counterparts in other regions (Engel, 2015). Physical infrastructure, the availability of offices, space for growing ventures, communications and transportation systems are also seen to play a role (Audretsch et al., 2011). As have, the music and art scenes and the general quality of life in a locality (Feld, 2012) and the ability of ventures to access markets beyond the specific location (Spilling, 1996).

The list of attributes of entrepreneurial ecosystems has become long and it is widely acknowledged that this weakness is caused by a number of factors. First, most prior research has

been conducted historically and has observed entrepreneurial ecosystems that have largely been successful (Roundy, 2017). Secondly, in such research it has been possible to identify the attributes of successful ecosystems but it has often been difficult to identify causality (i.e. what came first). Thirdly, observations of ecosystem formation show that prior histories and events, sometimes serendipitous, play unexpected roles (Feldman, 2001; Neck et al., 2004). Finally, because research, to this point, has largely focused on successful ecosystems it has been difficult to identify what deficits (lack of attributes) are the most critical in preventing progress (Harper-Anderson, 2018). Some aspects of causality, however, have been noted. Catalytic events have been observed, in Washington DC government restructuring led to an unlikely blooming of entrepreneurial activity there (Feldman, 2001), in Boulder Colorado the locating of an IBM facility, a subsequent spinoff venture and restructuring appeared to play an important role (Neck et al., 2004; Feld, 2012), while in Silicon Valley the presence of key research universities and federal research labs may have played a more important role than many realize (Engel, 2015). The presence of experienced and serial entrepreneurs in a locality also seems to stand out. These individuals provide knowledge, mentoring and capital to the next generation of ventures and can act as dealmakers (Feldman and Zoller, 2012). Organizations that become ‘incubators’ for multiple ventures are also highlighted from the prior work and have played a critical role in many contexts (Neck et al., 2004). These incubators range from established corporations, to government research labs, to highly successful entrepreneurial ventures (that IPO), to local universities. The common feature is that they become very competent at spinning out new ventures and breed a culture of entrepreneurial endeavor (Neck et al., 2004).

Despite the current progress and interest in this subject prior work can make depressing reading for those seeking to promote entrepreneurial activity in resource constrained

environments (Roundy 2017; Harper-Anderson, 2018). If the regional context is a small city, a rural area or university town the question remains how expanding knowledge about entrepreneurial ecosystems can assist economic development in these contexts (Roundy 2017). Successful entrepreneurial ecosystems require dense and open social networks that typically can only be found in larger cities. Access to capital, and particularly venture capital, is likely to be more difficult to obtain and human capital is likely to be thinner with much fewer key experienced entrepreneurs available. Other supporting attributes will likewise be different, infrastructure may be weaker, availability of professional support organizations that understand new ventures are likely fewer and availability of new intellectual property may be more limited. Such missing components seem to be inevitable in resource constrained environments and interactions between elements that are seen to be important in ecosystems are, therefore, likely to be lacking (Borissenko and Boschma, 2016). Yet, Silicon Valley was once farmland and the Research Triangle in North Carolina was once less developed, indeed other hotbeds of US innovation such as Cleveland and Detroit, declined in importance during the 20th century. So entrepreneurial ecosystems can come and go and the important question for resource constrained regions is not what attributes lead to success but how to get started given past history and current conditions (Roundy, 2017).

The role of universities in the development of entrepreneurship ecosystems is also somewhat unclear in the literature. It seems that all prior work agrees that having a university (or universities) within an ecosystem is important (Neck et al., 2004; Feldman, 2001; Spigel, 2015). In some views the university is a peripheral player providing resources to the ecosystem, which is led by entrepreneurs, dealmakers and investors (Feld, 2012; Feldman and Zoller, 2012). Typical important resources are acknowledged to be technological knowhow and intellectual

property, ‘young’, ‘energetic’ and ‘bright’ employees who can be employed in ventures, and provide important technical skills, and access to social networks through events, competitions and other forms of relationship brokerage (Autio et al., 2014). In other studies universities are seen to play a more critical role being ‘catalysts’, helping the ecosystem get started (Engel, 2015), and are viewed later in the process as ‘incubators’ of new ventures (Neck et al., 2004; Harper-Anderson, 2018). In these views the university takes on a more central role in the establishment and viability of the ecosystem and provides more than just resources. Researchers in the latter group will point to the role of Stanford, MIT, the University of Colorado at Boulder and the experience of the Research Triangle as evidence of the critical role universities can play within entrepreneurial ecosystems. Advocates in the former group point to numerous examples of other universities where the impact within the ecosystem is less evident (Harper-Anderson, 2018). From these studies it seems clear that universities have a role and sometimes this can be as a catalyst and incubator. It also is clear that the history, culture, structure and strategic intent of the university in its locality will influence its engagement and impact within an ecosystem (Siegel and Wright, 2015; Wennberg, Wiklund and Wright, 2011). Just as each locality, its history and culture will lead to a unique combination of factors that enable or inhibit the ecosystem each university has a unique history, culture and approach that will enable or inhibit its capacity to engage in entrepreneurial activity and be an important player in the establishment of an entrepreneurial ecosystem. So, next we consider how a university can become entrepreneurial and how in doing so it can enable the development of an ecosystem.

Entrepreneurial Universities

Like the literature on entrepreneurial ecosystems the concept of an entrepreneurial university has become popular (Etzkowitz et al., 2000; Etzkowitz, 2013). Conversations about

entrepreneurial universities link back to detailed debates over the nature of universities and their role in modern society (Martin; 2012). Should universities focus on education for citizenship and basic research or should they be demonstrating more material benefit to society? (Etzkowitz and Leydesdorff, 2000; Martin and Etzkowitz, 2000). Attitudes towards the role of universities in society have oscillated between a pure or immaculate ethos and an instrumental or utilitarian ethos (Martin and Etzkowitz, 2000). In the immaculate ethos research and teaching are conducted for their own sake, while in the utilitarian ethos they are focused on their impact and engagement with society. It has been argued that in the late 1980s the utilitarian ethos has been revived and that the entrepreneurial university is part of that shift (Etzkowitz, 1998; Etzkowitz and Leydesdorff, 2000).

The entrepreneurial university itself is a contested idea (Clark, 1988; Gulbrandsen and Slipersaeter, 2007). For some, the concept implies that universities prepare young people for a more complex world of work where personal development, entrepreneurship and innovation are required (Gibb, 2002). For others, the concept means that universities need to focus on commercial activity and research more effectively so that they maximize the value of their ideas, creating economic and social value for their communities (Clark, 1988; 2004). Some see the entrepreneurial university as an entity that engages and collaborates with other organizations more extensively than in the past (Etzkowitz et al., 2000). Each concept of the entrepreneurial university, however, implies greater engagement in its locality and support of regional entrepreneurial ecosystems and economic development. The literature interprets entrepreneurial universities *“as a step in the natural evolution of a university system that emphasizes economic development in addition to the more traditional mandates of education and research”* (Rothaermel, Agung and Jian. 2007: 708). Yusof and Jain (2010: 91), for example, argue that it

is “[...] a university that strategically adapts the entrepreneurial mindset throughout the organization and practices academic entrepreneurship which also encompasses technology transfer activities”. Gulbrandsen and Slipersaeter (2007) use the term for institutions that are not only general knowledge sources but are sources of knowledge that is increasingly commodified, embedded in patents and spin-off firms.

The triple helix model of the entrepreneurial university is perhaps the best known and used concept (Goldstein, 2010). In this model the university is a driver of the triple helix, which is characterized by the norms of capitalisation, interdependence, independence, hybridization and reflexivity (Etzkowitz, 2008). The emphasis is placed on the creation of an entrepreneurial culture within the university that enables opportunity recognition and entrepreneurial capacity building, leading to greater entrepreneurial endeavour. Some argue that universities have always been entrepreneurial and many universities have been established with this exact purpose in mind (Martin, 2012). For example, ‘polytechnics’ and ‘land grant institutions’ were derived from the idea that universities should be linked closely with industry and should create economic and social value. Different universities have been created with different purposes in mind and all universities have engaged in entrepreneurial activity to some degree (Etzkowitz, 1983; Gulbrandsen and Slipersaeter, 2007). While there may be a clear division between the ivory tower universities, on the one hand, and the engaged and entrepreneurial ones, on the other hand, the engaged universities and their entrepreneurial counterparts are not the same either (Goldstein, 2010). Though land-grant universities were responsible for the majority of large-scale war research projects and they became involved in patenting for the first time (Mowery et al., 2004) both the entrepreneurial and engaged universities share the utilitarian ethos, indeed it is

argued that “[t]he triple helix model goes well beyond being a single and logical extension of the ‘engaged university’” (Goldstein, 2010: 88).

In case of the entrepreneurial university a shift of “*the direction of influence in relationships between business and the university from business to the university*” can be observed (Etzkowitz, 1998: 825) or as Gulbrandsen and Slipersaeter (2007) summarized, a shift from user-directed commercialization towards science-directed commercialization. Simultaneously, there is a shift in the treatment of knowledge as a private rather than a public good. Goldstein (2010) argues that while engaged universities’ intellectual property right policies are viewed as a public good in entrepreneurial universities knowledge is considered a commodity and university’s view technology transfer as primarily a commercial activity (Shane, 2004). Etzkowitz (1998: 828) notes that “*the new entrepreneurialism is the old one plus the profit motive*” and he argues that in the past scientists would have felt that they were lowering themselves by achieving monetary gain on their inventions (Etzkowitz, 1983), that a normative shift has occurred (Etzkowitz, 1998) and now scientists consider fundamental knowledge extension and commercialization to be important in what is described as a “dual cognitive mode” (Etzkowitz et al., 2000).

Gibb (2002) extends the consideration of the entrepreneurial university beyond purely academic entrepreneurship and suggests that it is really more of pervasive culture of enterprise that spreads across entire institutions and engages both faculty and students. Others see the concept as disguised neoliberalism and suggest that the costs of higher education have been transferred from the public domain to the personal domain ushering in a form of privatization, whereby universities must become more accountable to consumers, more agile in their ability to self-generate funds and are ultimately ‘coerced’ to be more self-sufficient (Shumar and

Robinson, 2018). There are also concerns that increased commodification at universities poses threats to science and education (Bok, 2003; Slaughter and Leslie, 1997) and institutionalizes links with the political and economic organizations that can undermine the ‘disinterestedness’ ethos of universities (Goldstein, 2010).

The common view though is that universities are once again experiencing a paradigmatic change to their circumstances that requires a strategic response and many consider the ‘entrepreneurial university’ as the ideal way to address these challenges (Davidson, 2017). Notable changes include the increasing costs of education and the impact this has on the indebtedness of students, as well as, continuing declines in public funding and decline in the perceived public value of universities to society (Davidson, 2017). Alongside these changes new technologies (Martin and Etzkowitz, 2000) present new methodologies and modes of delivery, enable new private institutions and help launch potentially disruptive innovators; all of which appear to demand an adaptive and entrepreneurial response from established institutions who are dealing with deep legacies of established bureaucracy.

The idea that universities can be entrepreneurial ecosystems and hotbeds for new entrepreneurial activities is not without validation. It has been noted, for example, by Miller and Acs (2017) that many of the Forbes 2016 list of billionaires includes founders who launched from university campuses (e.g. Gates; Zuckerberg; Page; Brin; Knight; Dell; Allen) and their study of the University of Chicago highlights a number of significant examples, for example, Grubhub; Groupon; Bump Technologies; Simple Mills etc. (Miller and Acs, 2017). Licensing revenue at US universities in 2016 was reported to be \$2.9billion¹ and universities continue to take equity positions in start-up ventures (495 in 2016 in the US). This rise in the commercialization of science and university technology transfer has been noted (Siegel and

Wright, 2015) and growth has been occurring elsewhere in other countries (Grimaldi et al., 2011). Pressures to engage in entrepreneurial activity appear significant even when universities demonstrate little aptitude or success and there are questions over whether or not the returns to society are as great as would be expected (Siegel and Wright (2015). Competitive pressures from peers, declining public support increasing pressure to generate money from private donors and the growth of incentives from government agencies to support entrepreneurial endeavors are critical drivers (Siegel and Wright, 2015). Change in science and technology policy in line with the competitiveness agenda (Slaughter and Rhoades, 1996) and the importance of legislative changes¹, especially in the area of intellectual property (Mowery et al., 2004) are also seen to boost the entrepreneurial capacity of universities. There are also many examples, such as, University of Utah's \$45 million Lassonde Studios and Cornell's new 12-acre technology campus on Roosevelt Island, of significant investments into university based entrepreneurship ecosystems. The question remains, however, what factors and components help enable such 'entrepreneurial universities' to become established and successful (Gibb, 2002; Pittaway et al., 2018). A summary of the entrepreneurial university literature is presented in Figure 2

[Insert Figure 2]

Within the entrepreneurial university literature it is generally acknowledged that the role of the university in basic research remains important. Basic research provides the foundation for new technologies, new ideas and new ways of organizing and is the foundation of Schumpeter's concept of disruptive innovation (Schumpeter, 1971). How research is conducted, what disciplines and subjects are strong at an institution and the balance between 'blue sky' research and 'applied research' can have important implications for the existence of entrepreneurial

¹ It is important to note the differences between the American and the European contexts, for details see e.g. (Franzoni and Lissoni, 2009; Geuna and Rossi, 2011; Lissoni et al., 2008; Mowery and Sampat, 2005).

opportunities. The entrepreneurial capacity of the university is, therefore, strongly context dependent and the research being conducted influences both the nature of the entrepreneurial opportunities and the ventures that might emerge (Vohora et al., 2004; Wennberg, Wiklund and Wright, 2011). Contextual factors include which scientists are engaged in which disciplines (Stuart and Ding, 2006), the existing resource endowments of the institution including the level of public research funding received (Mustar et al., 2006), the processes and approaches used to engage in technology transfer (Lockett and Wright, 2005), the connectivity of researchers with industry and entrepreneurs (Bercovitz and Feldman, 2008) and the availability and connectivity that researchers have with the local entrepreneurial ecosystem, as well as, the quality of that ecosystem (Harper-Anderson, 2018).

Each university draws on unique conditions and resource endowments that influence its capacity to be 'entrepreneurial'. Some of the research in this subject has led to non-obvious conclusions. For example, universities can have significant public research funding and be leaders in basic research but not be very successful at transferring the outcomes of research to society through entrepreneurial endeavor (Lockett and Wright, 2005). Universities (e.g. Stanford and MIT) that have focused on applied research, particularly in engineering, have been highlighted as being successful at academic entrepreneurship (Engel, 2015). While universities that have been focused more on the education of students, rather than basic research, have shown a capacity to spawn high volumes of indirect spillovers via student and graduate entrepreneurship and have not inherently been limited by the fact they have less access to basic research funding and outcomes (Siegel and Wright, 2015). So basic research plays a wider role in a society's capacity to generate new technologies and entrepreneurial endeavor but at the institutional level it is no guarantee that the university will create more spillovers and benefits for

its locality beyond the immediate gains drawn from additional grant income (Clarysse et al., 2014).

Siegel and Wright (2015) highlight that the entrepreneurial universities may require more focus on academic entrepreneurship and that this does not imply a decline in basic research, “*a stronger emphasis on commercialization and academic entrepreneurship actually leads to an increase in basic research... because most of the ‘profits’ from commercialization are ploughed back into basic research*” (Siegel and Wright, 2015: 584)². What has been established is that traditional methods of ‘patent and license’ of technology transfer has given insufficient focus to the start-up dimension of academic entrepreneurship (Lockett, Wright and Wild, 2014). Early studies, for example, of Technology Transfer Offices (TTOs) show significant variation in the ability of TTOs to deliver on traditional performance metrics (Rothaermel, Agung and Jian, 2007). The perceived quality of the TTO can have a significant impact on scientists’ decision to disclose their inventions (Owen-Smith and Powell, 2001).

Technology transfer is important in the entrepreneurial university literature but a new model is also beginning to be proposed (Wennenberg, Wiklund and Wright, 2011). In this model wider indirect dimensions of technology transfer are considered including, incubators, accelerators and science parks; entrepreneurship programs, centers and extra-curricular activities; and, the involvement of entrepreneurs in residence and alumni entrepreneurs, including via their donations and mentoring (Siegel and Wright, 2015). Indeed, these new models seem to point towards a general orientation of universities to become entrepreneurial through all aspects of their work including research, educational and outreach activities (Gibb, 2002). This perspective of university-wide entrepreneurship is thought to include both educational practices and

² Similarly, cross-funding between faculties and/or departments can support fields with lower level of entrepreneurial opportunities Clark (1998).

community engagement, as well as, venture formation and licensing (Morris, Kuratko and Cornwall, 2013). This more encompassing perspective of the entrepreneurial university (Gibb, 2002) raises important questions. How does a culture of enterprise takeoff and/or become established at an institution? What role does entrepreneurship education play in helping an institution itself become more entrepreneurial? How does an entrepreneurship program build connectivity between the institution and the locality so that the wider entrepreneurial ecosystem is impacted and positive economic development outcomes occur? If the university is in a resource constrained environment, such as a small city or rural area, how does it have a disproportionate impact on the local entrepreneurial ecosystem? These questions point to two considerations we will address next. First, we will explore the entrepreneurship education literature and consider what it says about the establishment of an entrepreneurial ecosystem and second, we will consider how entrepreneurship education can help facilitate the building of an entrepreneurial ecosystem in a constrained context.

Operationalizing an Entrepreneurial Ecosystem

The literature in entrepreneurial ecosystems and entrepreneurial universities show important trends in thinking that should inform research in entrepreneurship education and learning (Foss and Gibson, 2015). In entrepreneurship ecosystems it is becoming clear that universities play a critical role, that social capital, networks, mentoring and the acquisition of entrepreneurial capacity in a locality are all important attributes. In the entrepreneurial university literature it is likewise clear that thinking is expanding beyond narrow conceptualizations of technology and knowledge transfer towards a recognition of the role of indirect forms of entrepreneurship, such as, university wide entrepreneurship education and informal student venture creation. These systemic level studies, focusing on locality and

institutions, have begun to acknowledge the role of operational level attributes normally associated with study in entrepreneurship education and learning. Unfortunately, research and study in entrepreneurship education and learning is almost silent about these wider systemic conditions and does not deeply consider how educational practice should engage with the university as a whole and or the local entrepreneurship ecosystem (Pittaway et al., 2019).

Prior reviews of entrepreneurship education highlight this notable absence (Dainow, 1984; Garavan and O’Cinneide; 1994a; 1994b; Gorman, Hanlon, and King; 1997; Pittaway and Cope, 2007; Mwasalwiba; 2010; Martin, McNally, and Kay; 2013; Naia et al., 2014; Wang and Chugh, 2014; Loi, Castriotta, and Di Guardo, 2016). These studies show that operational considerations of entrepreneurship education have focused ostensibly on: 1) *Pedagogy/Andrology* – which focuses on methods, design and strategy of educational interventions; 2) *Propensity, intentionality and self-efficacy* – which explores the extent to which educational interventions change student’s perceptions and behaviors; 3) *Entrepreneurial learning* – which considers in depth how entrepreneurs learn in the context of their everyday work; 4) *Measurement and evaluation* – which investigates outcomes from educational practice and how to measure it; 5) *Typologies and taxonomies* – which considers the forms of educational practice in entrepreneurship education; 6) *Context and application* – which observes the different contexts and practices that are used and considers their relevance in particular settings.

The literature on entrepreneurship education does not fully address these systemic issues, such as, the role of educational infrastructure (Pittaway et al., 2018), the organization of programs and how this might be effective in certain contexts (Pittaway and Cope, 2007; Pittaway and Hannon, 2008). Likewise the entrepreneurial learning literature rarely considers the wider social context of learning in the sense of how it might contribute to an ecosystem or an

institution as a whole (Pittaway, Huxtable-Thomas and Hannon, 2018). Consequently, key questions are overlooked. For example, how does the organization of entrepreneurship education improve a university's ability to engage in entrepreneurial activity (licensing, formal venture creation, informal venture creation and knowledge exchange)? How does entrepreneurship education facilitate improvements in the human capital base at an institution and improve both student and academic entrepreneurial efforts? How does educational practice engage with basic and applied research to improve the transfer of intellectual property from the university to the community? To what extent can the design of educational practice improve social capital and networks between the institution and its ecosystem (through consulting; volunteering; service learning; entrepreneurial mentoring; events and competitions)? It would seem that a wider perspective that places operational activities in their institutional and ecosystem contexts might have considerable merit moving forward within the research domain of entrepreneurship education. Indeed, many of the practices that are growing in importance, such as, increasing investments in infrastructure, the establishment of Centers, Institutes and Schools of Entrepreneurship and the new trend to appoint senior leaders focused on university-wide entrepreneurship and innovation suggests that this systemic level focus is already occurring in practice if not within the research domain.

The closing part of the paper will thus seek to consider these operational considerations and bring together the literature across these three research domains. We will explore how an institution might become more entrepreneurial by deliberately building an entrepreneurial culture, we will investigate the operational implications of doing so and consider how such a system can be built while simultaneously enhancing the entrepreneurial ecosystem within a constrained context, such as, a small city or rural location (Belitski and Heron, 2017). Our

model is presented in Figure 3 in the construction of the model we follow Stam's (2015) organization of entrepreneurial ecosystems by making a distinction between functional attributes being the part of the framework conditions the systemic conditions. Framework conditions represent the 'system' part of the ecosystem, while systemic conditions represent the 'eco' part. (Stam, 2015). Within our conceptualization we also include Stangles and Bell-Masterson's (2015) measure of 'vibrancy' which considers the density, fluidity, connectivity and diversity of an ecosystem. An ecosystem thus feeds on itself with vibrancy increasing as functional attributes, belonging to the framework and systemic conditions alter (Stam, 2015).

[Insert Figure 3]

Framework conditions

In the context of entrepreneurial ecosystems functional attributes of the framework conditions represent the 'system' part (Stam, 2015). They contain the existing historical, cultural and institutional constraints/enablers that exist within a regional context. As noted in Figure 1, legacies of location related to its prior industry, history of entrepreneurship, religious and cultural history, prior population demographics and regulatory history, will set the starting conditions for an entrepreneurial ecosystem (Audretsch et al., 2011; Autio et al., 2014). Likewise the cultural conditions, such as, attitudes towards entrepreneurship and the existence of current institutions play an important role in setting the scene within which entrepreneurial efforts occur (Borissenko and Feldman, 2008; Spiegel, 2015). In a constrained environment there are likely to be many deficits in these starting conditions (Roundy, 2017). For the purposes of our focus we assume the existence of a university as an institution within these functional attributes and note that universities have been catalysts for the establishment of ecosystems previously (Feldman, 2001; Neck et al., 2004).

Other deficits may exist. The industrial history of a location may or may not be conducive to entrepreneurship. Localities that have been dominated by one or two large industries or single employers are not known for being particularly entrepreneurial until necessity requires it (Feldman et al., 2005). Localities with competence in technologies that re-emerge or that can be repurposed can reignite entrepreneurship (Feld, 2012) and places that lack prior entrepreneurial endeavor will have fewer role models, mentors and dealmakers (Feldman and Zoller, 2012). Similarly, contexts that have a history negatively inclined toward entrepreneurship, such as former communist countries and regions, might find the cultural context challenging and difficult to change and institutional deficits, such as, poor regulatory conditions may create insurmountable barriers. These challenges can be evident in any regional entrepreneurial ecosystem but are likely to be more pronounced in constrained environments (Roundy, 2017). In particular, economic density, population fluidity, cultural change, venture incubation and missing institutions can be significant constraints in a small city or rural locality (Roundy, 2017). How might an entrepreneurial university help offset these challenges?

Economic Density and Population Fluidity

The nature of the economic density in a locality has been shown to impact on the entrepreneurial ecosystem (Aldrich, 1979; Stam, 2015). Density consists of many aspects but notably includes the number of births and deaths of firms (or the churn rate), the amount of employment in high technology ventures and the presence of research and development and venturing functions of larger organizations (Engel, 2015). Population fluidity is also considered a factor (Feld, 2012). Here it is recognized that ‘flow’ of population into and out of a locality may play a role in the diversity of ideas and creativity present (Spilling, 1996) and that the

capacity of employees to flow between ventures and in/out of established businesses is conducive to vibrant entrepreneurial ecosystems (Malecki, 1997; Kenney and Patton, 2005).

Constrained environments are more likely to have less economic density, lower churn rates and less population mobility (Roundy, 2016). Less economic density occurs because there are simply fewer firms, and fewer entrepreneurs, which can lead to lower startup rates. Fewer firms also implies less employment opportunities and lower rates of population mobility. The presence of a university can potentially ameliorate these impacts (Clark, 1998; 2004). A university increases population mobility, a new generation of young people from diverse locations are constantly arriving (and leaving) and highly educated faculty are recruited to the community (often from a wide range of locations). Often this population is educated, diverse and full of energy for new ideas, which can be a source of entrepreneurial vibrancy (Feld, 2012). In smaller communities the retention of the student labor post-graduation can continue to pose challenges and many of these graduates do leave to take up jobs in metropolitan locales. The presence of population flow though can offer potential for efforts designed to retain skilled labor, specifically in the context of entrepreneurship education, those efforts focused on student venture creation, such as, student incubators and accelerators (Pittaway and Cope, 2007; Siegel and Wright, 2015).

A university, with deliberate effort, can also offer programs that serve employers in the location or choose to offer subjects that are conducive to entrepreneurial endeavor (such as, entrepreneurship and technology programs). A university can also impact the density of businesses. For example, its mere presence increases the number of businesses in services, retail and hospitality serving students and faculty and this effect can be enhanced via deliberate 'buy local' procurement decisions. The presence of a skilled potential workforce in a location, which

might be underdeveloped but cheaper than its metropolitan counterparts, can be an attraction factor for existing businesses to relocate. In the entrepreneurial ecosystem literature it is evident that such relocations have occurred (e.g. IBM to Boulder Colorado) and have been catalytic in the establishment of successful ecosystems (Neck et al., 2004). Other ‘attraction’ factors are evident in the literature, such as, the establishment of federal research labs in Silicon Valley, as a consequence of Stanford’s presence, which were instrumental in the development of that ecosystem (Engel, 2015). An entrepreneurial university would thus likely engage with local economic development agencies to promote their presence in the region, would aim to enhance student entrepreneurship, the employment of students locally, would develop ‘buy local’ procurement policies and, would seek to help attract new organizations to the region. Entrepreneurship education clearly has a role, for example: by being offered as a program of study; by being embedded in technology courses; by supporting student ventures; and, by engaging in regional policy decision-making.

Cultural Change

The ecosystem literature highlights clearly the role that local culture might have in entrepreneurship (Feldman, 2001). Risk aversion, inability to cope with uncertainty and ambiguity and fear of failure are just a few of the cultural inhibitors. Each locality will have its own history that will lead to a supportive or unsupportive culture. Resource constrained locations are no different in this regard to other locations, small cities and rural locations can have a highly conducive culture towards entrepreneurship but may lack other resources and attributes (Roundy, 2017). Likewise they can have a poor entrepreneurial culture. The culture of universities towards entrepreneurship is also considered to vary considerably with some having very conducive cultures and others less so (Lockett and Wright, 2005). The role of an

entrepreneurship program in seeking cultural change has been highlighted and is often the reason for government investment in entrepreneurship education (Gibb, 2002), though it remains debateable whether such change occurs (Loi et al., 2016).

Operationally, however, it is conceivable that a university's entrepreneurship program may play a role in encouraging changes in attitudes towards entrepreneurship within the university and locally. Common entrepreneurship activities, such as, pitch competitions, business plan/business model competitions, events, invited speakers, and so forth, clearly help programs engage with entrepreneurially minded students, academics and locals. These activities typically engage large numbers of people and attempt to shift the entrepreneurial mindset on campus. If they are open to local engagement and involve local people as competitors, judges, observers there are also potential spillovers to the local culture of the community in which the university is located. Other common activities, such as, PR efforts to celebrate alumni, local and student entrepreneurs can have similar impacts on the local culture within the entrepreneurship ecosystem. It is clear, therefore, that entrepreneurship education programs, if effective, can have an impact on the campus and community culture, and thus positively assist the development of an entrepreneurial mindset. The entrepreneurship education literature shows, however, that this can be difficult to achieve (Etzioni, 1987; Stuart and Ding, 2006; Kibler et al. 2014). What is also evident though is that "collective programming" (Hofstede, 2001) in a location can lead to increases in social legitimacy of an activity (Etzioni, 1987), which may impact of the social acceptance of an entrepreneurial culture (North, 1994). Some of the features of entrepreneurship programs, such as competitions, have this attribute aimed at creating a trigger towards a 'herding' or 'buzz' effect (Barthelt et al., 2004), which can intensify entrepreneurship as a legitimate practice (Fritsch and Wyrwich, 2018).

Incubation and Catalytic Change

As noted previously the entrepreneurial ecosystem literature is clear that certain institutions and events can lead to significant ecosystem changes that promote a period of entrepreneurial growth (Feldman, 2001). Particular institutions can be catalysts for above average numbers of ventures (Neck et al., 2004) and certain events, such as, mass redundancies, a significant corporate venture, a successful IPO of a local firm, for example, can lead to a more general blossoming of entrepreneurial endeavor in a locality (Feldman, Francis and Bercovitz, 2005). Both the entrepreneurship ecosystem and the entrepreneurial university literatures show that it is possible for a university to play this role within an ecosystem. It is also evident that many universities struggle to do so successfully (Siegel and Wright, 2015). Though traditionally academic entrepreneurship has been led from TTOs and has focused predominantly on licensing intellectual property (Lockett and Wright, 2005) there is scope for a university-wide entrepreneurship program to encourage a change of focus towards more local spinout ventures, both technology/academic led and student led (Siegel and Wright, 2015). The experience of ecosystems connected to the University of Cambridge, Stanford and the Research Triangle shows a few highly catalytic successes can subsequently lead to a significant shift in the entrepreneurial potential of a locality (Engel, 2015). One or two significant successes that lead to IPOs, trade sales or other spinoffs can transform a locality, especially when such success spawns second and third generation ventures.

For constrained environments lower density of businesses and lower churn rates puts limits on the probability of producing such outliers (Roundy, 2017). An entrepreneurship education program can assist such localities in several ways. It can help shift the traditional TTO mindset away from a pure licensing model to one of spinoff ventures in the locality (Siegel and

Wright, 2015). It can assist with the creation of more ventures through enhanced student entrepreneurship. It can work with academics and other researchers across campus to enhance their understanding of the entrepreneurial process and assist the acceleration of ventures. Finally, it can work with local ventures on business models, identify and support opportunities that offer catalytic change and help advance those activities that could be outliers. Such efforts, may enhance the likeness that the university could become the incubator that a constrained context needs given its lack of business density and entrepreneurial churn. Incubators can be planned but they can just occur and so an entrepreneurship program can effect change even where strategic support may not exist at the institutional level within the university (Neck et al., 2004).

Enabling Infrastructure

Constrained environments, by definition, have many resource deficits when the enabling infrastructure is considered (Stam, 2015; Roundy, 2016). Constraints may include basic infrastructure, such as, roads, airport or port access and broadband accessibility, as well as entrepreneurship infrastructure, which could include: co-working space for startups; labs; incubators; and, appropriate space for growing companies (Roundy, 2017). Many of the ecosystems studied in the literature that have been historically successful, it can be argued, did not have significant deficits in terms of basic infrastructure, though some clearly built such infrastructure up over time (Feldman, 2001; Engel, 2015). Of course constrained localities, particularly rural ones, may have significant deficits in basic infrastructure, as well as, deficits in specific infrastructure supporting entrepreneurship. The presence of a university for such locations is important in addressing these issues. The mere presence of a university can have

positive effects on both road infrastructure and access to broadband and certainly the latter has become important for many modern ventures.

In addition, many universities, and specifically entrepreneurial ones, have invested in entrepreneurship infrastructure. It is not uncommon for a university to have dedicated incubation facilities and some have built Science Parks. The establishment of a Science Park, for example, was critical in the development of the Research Triangle (Feldman, 2001). Increasingly, universities are investing in student venture pre-incubators and incubators, rapid prototyping labs, wet labs, mixed used entrepreneurship spaces and even entrepreneurial dorms (Pittaway et al., 2019). A constrained context, such as a small city or rural area, would unlikely be able to have such entrepreneurial support infrastructure and so if a university creates such spaces and has a local economic development focus with these efforts, there is significant opportunity for local impact (Gibb, 2002). A vibrant entrepreneurship education program plays an important role for an entrepreneurial university in utilizing such infrastructure. It helps ensure programmatic activities that are required to gain value from the spaces made available and its presence helps make the case for such investments in the first place (Pittaway and Hannon, 2008; Feters, Greene, Rice, and Butler, 2010).

Systemic Conditions

Systemic conditions are the ongoing attributes that establish the functioning of the ecosystem and can be considered the ‘eco’ part, constantly changing and adapting (Stam, 2015). They importantly include the people, for example, the entrepreneurs, the investors, the mentors and the dealmakers (Feldman and Zoller, 2012). Such conditions also include the density and connectivity of social networks and the existence of social capital in these networks (Feld, 2012). Additional components include the availability of financial capital, the value of professional

support networks and the availability of new knowledge and technologies that can be commercialized (Stam, 2015). Once again constrained environments can lack many of these key ecosystem ingredients (Roundy, 2017).

Human capital can be particularly problematic. By definition a constrained locality, such as a small city or rural region, has fewer people and this means fewer potential entrepreneurs, investors, mentors and dealmakers (Roundy, 2017). It will likely have less dense social capital networks though potentially higher levels of connectivity and is likely to find access to capital and qualified venture support challenging (Roundy, 2017). A constrained context that does have a university, however, can potentially address some of these limitations. In particular an entrepreneurial university and its entrepreneurship education efforts may have an impact on human capital (creation and acquisition), social capital, knowledge creation (and spillover) and funding intermediation.

Human Capital Creation and Acquisition

As noted population fluidity is an important ingredient within entrepreneurial ecosystems (Stam, 2015). It plays an important role because of the essential need for human capital within entrepreneurial endeavor (Feldman and Zoller, 2012). Obviously, entrepreneurial activity needs entrepreneurs but it also needs entrepreneurial mentors, investors, dealmakers and leadership, executive and technical labor. Ecosystems that are vibrant are recognized to have many serial entrepreneurs and have the presence of successful entrepreneurs who have had exits, and whom act as mentors, dealmakers and investors for new ventures (Feld, 2012; Feldman and Zoller, 2012). Constrained environments have fewer people in general and consequently fewer key people that could build high growth ventures (Roundy, 2017). They may also have a tendency towards small businesses rather than growth/technology orientated businesses. Small cities may

also lack ‘executive/leadership’ talent that might be required at later stages of venture growth and can experience skill deficits in other areas, such as, those skills associated with critical technologies relevant to the business (Roundy, 2017).

Entrepreneurial universities and entrepreneurship programs can play an essential role when human capital is lacking (Duval-Couetil, 2013). Clearly, the core of a university’s job is education and so this is where it plays its most important contribution within an ecosystem. An effective entrepreneurship program can help educate students ‘about’ entrepreneurship and can support entrepreneurial efforts by engaging in ‘for’ and ‘through’ forms of entrepreneurship education (Jamieson, 1984). Programs can also attract talented academics, technology experts, entrepreneurs and executives as educators, many of whom bring human capital of value beyond the traditional academic sphere. Education programs can be offered to assist high school students, academics and local people that can have an impact both on the local entrepreneurial culture and entrepreneurial activity. A university can also assist directly with the supply of appropriate technical skills for ventures (Feld, 2012) and if it provides infrastructure and gains some success it can be a magnet for established/serial entrepreneurs and investors. Likewise an entrepreneurial university that is proactive at licensing its technology to spinout ventures can attract entrepreneurial talent to the locality, as entrepreneurs seek to license technology and start ventures. So while human capital for entrepreneurship may remain a constraint it is evident that a university has the capacity to alleviate this constraint considerably via a deliberate educational program and through its general technology transfer and educational programming efforts.

Social Capital Connectivity, Mentors and Dealmakers

The majority of studies, as well as considering human capital, point to the important role of social capital in successful ecosystems (Coleman, 1988; Spilling, 1996). In the studies the

role of social capital is somewhat contentious but in general deep networks between entrepreneurs, mentors, dealmakers and investors are viewed to provide critical links between ventures and other stakeholders and encourage deal flow (Feld, 2012). Dense networks that have many players but that are simultaneously deep, in the terms of connectivity, are thought to be particularly advantageous (Spigel, 2015). By definition resource constrained localities are likely to lack dense networks, though it possible that they can have deep networks, in terms of the quality of ties and the level of connectivity (Roundy, 2017). A university presence in such a community can assist deficiencies in social capital as universities are often valuable knowledge brokers (Vohara, Wright and Lockett, 2004).

Within the context of entrepreneurship program several aspects of knowledge brokerage seem evident (Mueller, 2006). Events, competitions and physical spaces can act to bring cross-disciplinary and cross-community groups together including students, alumni, academics and locals. Start-up Weekends are good examples of this phenomenon, as are small consulting projects that allow students to work with local entrepreneurs. The establishment of mentoring programs that leverage successful alumni entrepreneurs from outside the local community into mentoring, dealmaker and investor roles can add social capital connectivity that might not exist otherwise. The capacity of entrepreneurial teams from universities to access social capital in wider networks via a university affiliation through business plan competitions, innovation programs and accelerators, for example, are further illustrations of how a university in a restricted context might assist the expansion of social capital available to a local community. These broader national and global networks are more accessible to universities and are becoming increasingly important for access to funding and markets (Engel, 2015). Programs that

deliberately leverage such opportunities are consequently opening up the ability of the community to access social capital in other localities.

Knowledge Creation and Spillover

Having new knowledge and technology available in a locality is also recognized to be an important ingredient in the success of an entrepreneurial ecosystem (Autio et al., 2014). The context and history of a community will play an important role, the existing industrial history and community's technical knowhow based on this prior history influences the nature of the venturing that can take place (Pitelis, 2012). Spillovers can occur from established institutions, especially where these are research and technology focused (e.g. research labs and universities) though the chances of spillovers are acknowledged to vary between institutions (Lockett and Wright, 2005). Resource constrained localities will likewise be limited by their prior history and will also have fewer institutions from which spillovers can occur (Roundy, 2017). Knowledge creation and spillover activities in small cities and rural locations will restrict the capacity of the ecosystem to create high growth ventures based on new technologies and/or business models. The presence of university, once again, can ameliorate this restriction but it will depend on the university's capacity to generate new knowledge and its effectiveness at creating spillovers with this knowledge (Etzkowitz, 1983; Kenney and Patton, 2005). Entrepreneurial university's will clearly be focused more on this by enhancing the licensing of technology to entrepreneurs, by engaging in academic spinoff ventures, as well as, by engaging in licensing and will seek knowledge that has application and commercialization potential (Gibb, 2002). Entrepreneurship education has a role: it can help enhance the TTO efforts in licensing and spinoff through networks to alumni entrepreneurs; it can provide programs to academics to help inform and

encourage the knowledge spinoff process; and, it can include knowledge, technology and commercialization processes in educational programs.

Funding Intermediation

The final framework condition that appears to dictate the vibrancy of an ecosystem is the availability of venture finance, including all forms: friends and family, crowdfunding, debt finance from banks, informal business angel investors, angel investor syndicates and venture capital (Florida and Kenney, 1988; Stam, 2015). Constrained contexts naturally have more limited access to finance. Fewer entrepreneurs means fewer exits, making less capital available locally, and fewer entrepreneurial businesses means less deals to attract potential investors (Roundy, 2017). Early stage capital can help things get started, for example through friends and family, crowdfunding and banks, but follow on finance, such as, venture capital funding can be hard to attract to remote locations. Fewer successful entrepreneurs also means less potential for informal business angels and lower probability that an angel syndicate will become established. Consequently, access to finance for ventures in small cities and rural locations is always likely to be a significant challenge and will constrain the ecosystem (Kenney and Patton, 2005). A university and an entrepreneurship program in such a context can play a role in a range of creative ways. It can use its alumni networks to connect local ventures to informal investors elsewhere, it can establish its own venture finance programs, for example, by developing microfinance, engaging in crowdfunding, establishing angel investor syndicates and even managing its own venture finance funds. The entrepreneurship program can also be involved in the establishment and management of such networks and funds and it can become part of the educational fabric of the program involving students in the administration and support of ventures (Rice, Fetters and Greene, 2014).

Conclusions

In this paper we conducted a detail review of the entrepreneurship ecosystem and entrepreneurial university literatures. Work on ecosystems is advancing and there are many common attributes of successful ecosystems identified (as presented in Figure 1). There is, however, less work presently that explains the causality of attributes (i.e. what comes first) and little study that helps explain how small cities, university towns and rural locations can address their attribute deficits. In the ecosystem literature it was evident that universities play an important role in entrepreneurial ecosystems, though there was some disagreement about the nature of this role. For some universities were bit part players providing resources while for others universities played a key role as catalysts, brokers and incubators of entrepreneurial ventures. In the review of the entrepreneurial university literature we further explored how universities can act to support entrepreneurial endeavor, local economic development and engagement. This literature showed the concept of the ‘entrepreneurial university’ to be contentious but evidently growing in importance and increasingly the focus of public policy. Entrepreneurial universities were shown to have attributes that enabled them to be fully engaged in their local economy but in such a way that they applied knowledge and were effective at commercializing it. A feature that is somewhat rarely achieved successfully for most universities (as presented in Figure 2). The concluding part of the paper considered what we know about entrepreneurship ecosystems and entrepreneurial universities to consider how a university might help the establishment of an entrepreneurial ecosystem in a constrained environment. This part of the paper synthesize the frameworks presented into a model that can be empirically tested in a field study (as presented in Figure 3).

The literature reviewed and the conceptual model developed illustrates some important issues. First, it is evident that on many of the ‘ingredients’ of a successful entrepreneurial ecosystem resource constrained environments would have many gaps. Lack of density of businesses, poor population fluidity, lack of existing incubators, poor infrastructure, lack of appropriate human capital, lack of density in social networks, low knowledge creation, as well as, poor access to finance, would limit such locations ability to engage in high value added entrepreneurship. Building an entrepreneurship ecosystem in such contexts is, therefore, inherently challenging. The model presented suggests that the presence of a university in such locations, should greatly enhance their prospects of progress but that the nature of the university itself would impact likely outcomes. Universities that make concerted efforts to be entrepreneurial and that have entrepreneurship programs have strategies available to them that can enhance entrepreneurship ecosystems over time.

The contribution of this paper is begin to show ‘how’ a university and its entrepreneurship program more specifically can operationally address deficits in a local ecosystem and how it might begin to bring about positive change. The paper also opens up new avenues for entrepreneurship education researchers. Much study is focused on the ‘individual’, ‘course’ and ‘program’ units of analysis. This paper shows that a more ‘systemic’ level analysis of institutions and local entrepreneurship ecosystems within entrepreneurship education may allow researchers and educators to consider more widely the strategic objectives that might be achievable for programs. The work thus invites researchers to consider broader questions, such as, how does the organization of entrepreneurship education improve a university’s ability to engage in entrepreneurship and local economic development? How does entrepreneurship education help improve the human capital base in a locality? How does educational practice

engage with technology transfer processes and commercialization efforts? (etc.) These questions, we contend, are important if pressures continue to build for universities to become more entrepreneurial and more directly impact their local economies.

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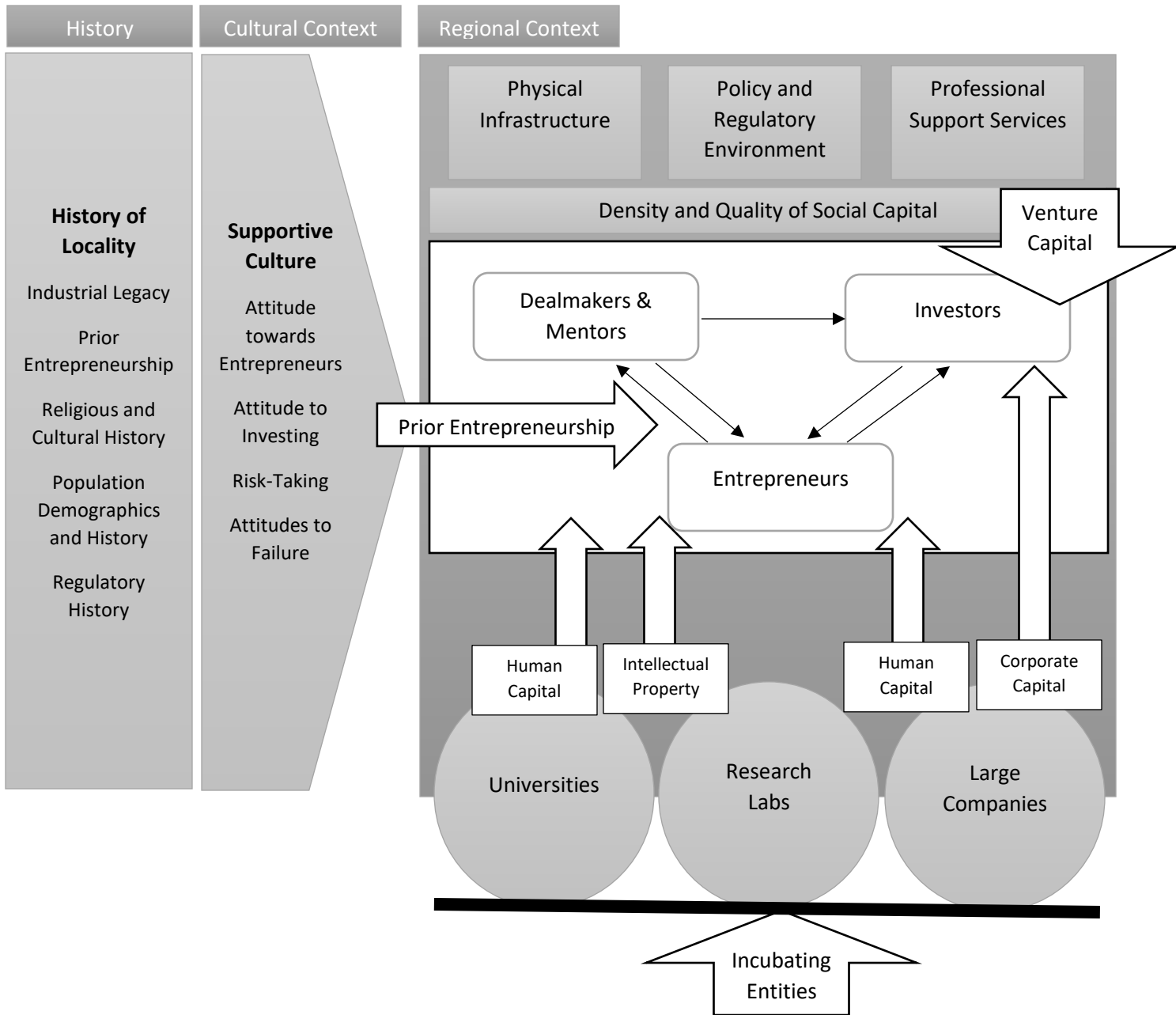
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Figure 1: Common Attributes of Entrepreneurship Ecosystems



Constructed from: Van de Ven, 1993; Feldman, 2001; Neck et al. 2004; Feldman, Francis and Bercovitz, 2005; Feldman and Zoller, 2012; Engel, 2015; Spigel, 2015.

Figure 2: The Entrepreneurial University

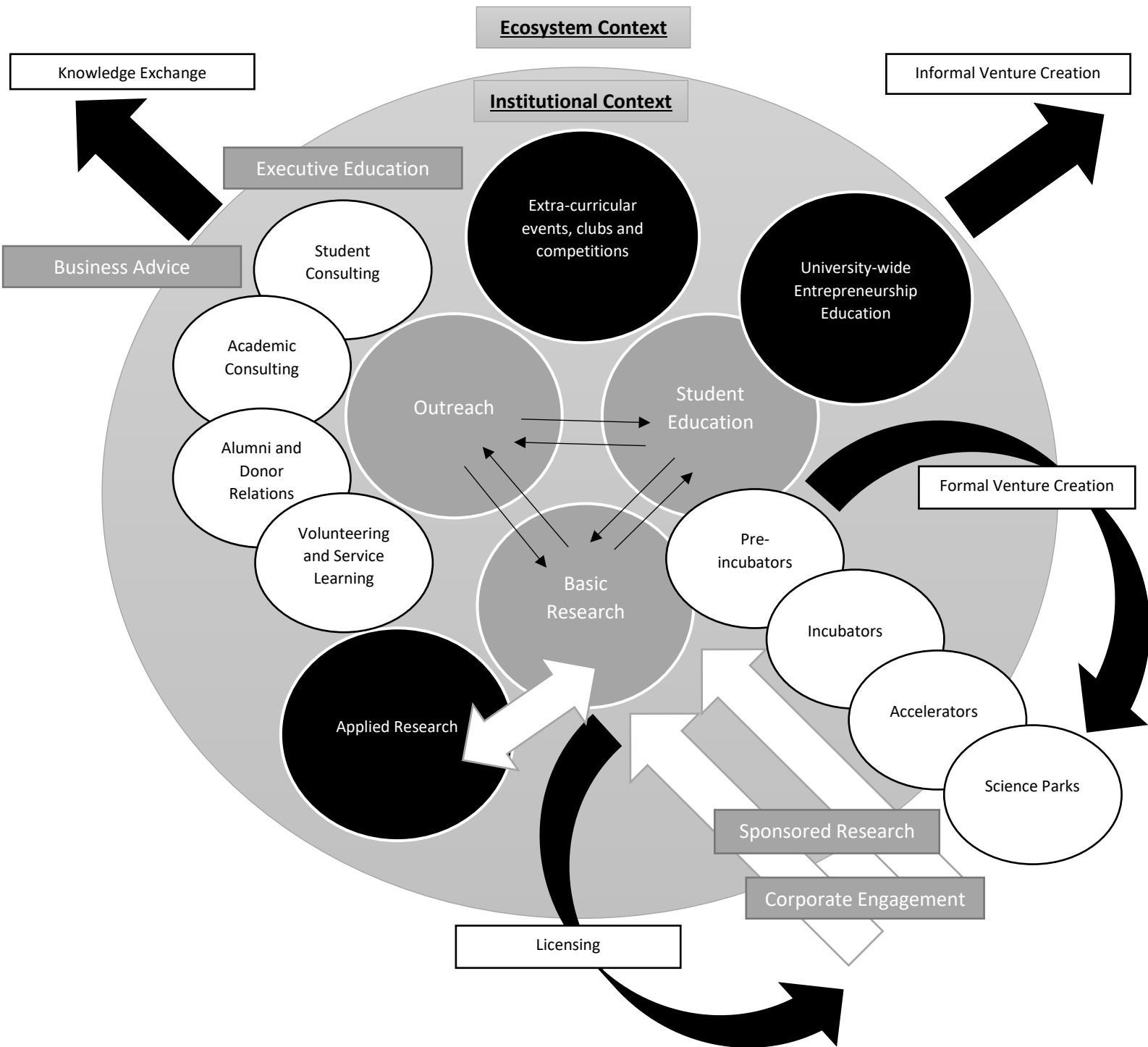
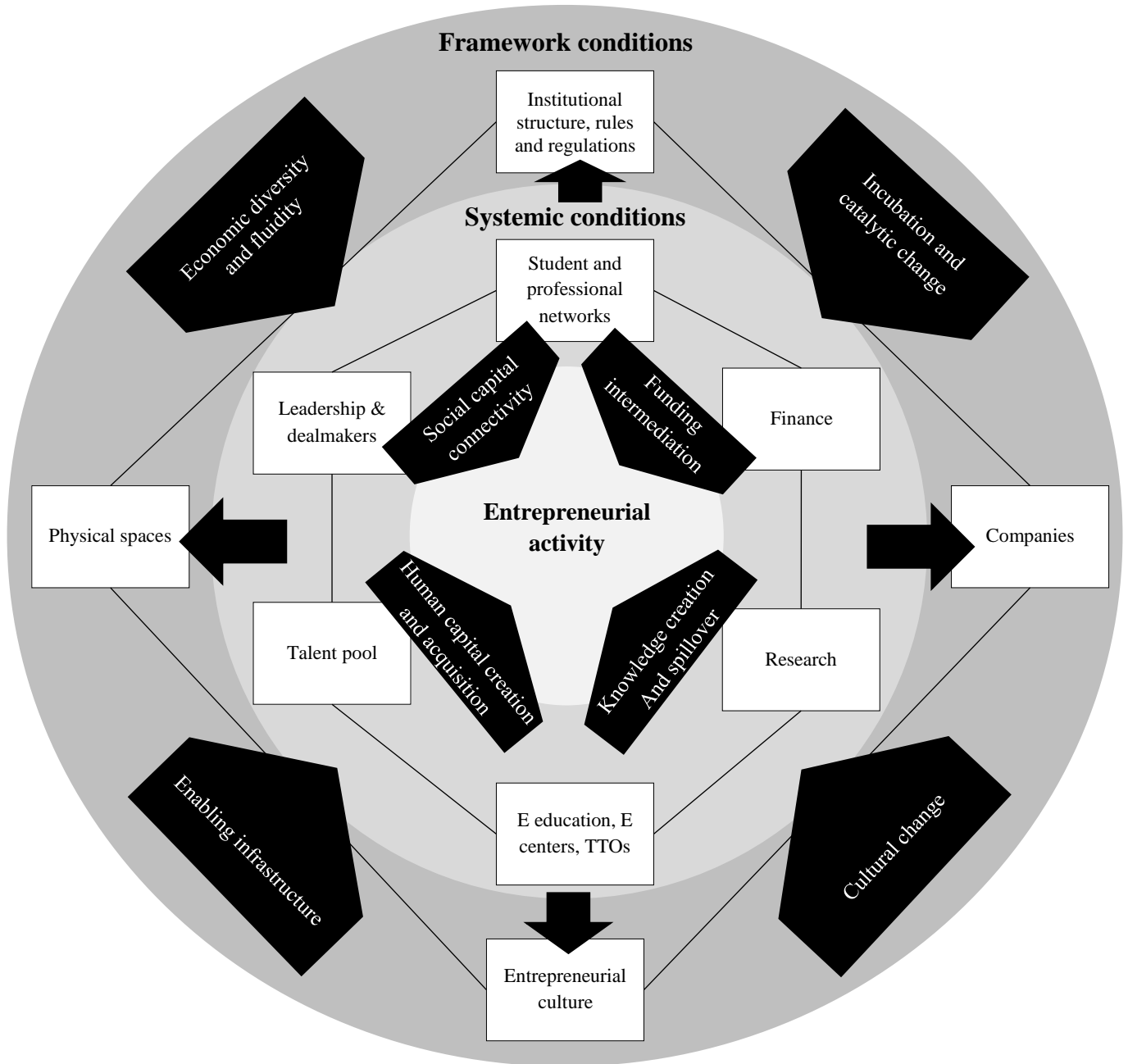


Figure 3: The University Centered Entrepreneurial Ecosystem



Source: Authors based on Stam (2015).

ⁱ <https://www.insidehighered.com/quicktakes/2017/11/29/start-ups-licensing-income-2016>