12-2016

Measuring Entrepreneurial Ecosystems

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December 2016

Funding Provided by:

Ewing Marion
KAUFFMAN
Foundation

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EXECUTIVE SUMMARY

INTRODUCTION

Whether we realize it or not, our communities have an entrepreneurial ecosystem. Whether it's a networking event at a local chamber of commerce or a venture capital firm investing in a startup company, each activity that facilitates entrepreneurial growth is a component of this ecosystem. Some indicators of the entrepreneurial ecosystem have direct ties to startup growth (e.g. venture capital investment), while others are indicators necessary to build-out capacity (e.g. talent attraction and education).

Examining entrepreneurial ecosystem measurement is an interesting and important research activity for several reasons. First, there is a significant amount of taxpayer investment in play through public financing of small businesses and early stage companies. Second, practitioners and funders are currently seeking ways to expand entrepreneurial activity in order to increase regional prosperity.

The goal of this research study is to quantitatively and qualitatively explore the indicators of entrepreneurial ecosystems. This study, with support from the Ewing Marion Kauffman Foundation,[1] focuses on two major questions: 1) what are the indicators of an entrepreneurial ecosystem, and which of these best reflect the ecosystem's vibrancy? And 2) what indicators of entrepreneurial ecosystems are most valuable for entrepreneurs?[2]

A mixed methods approach was used to answer these research questions. This paper uses the framework established in the white paper "Measuring an Entrepreneurial Ecosystem" by Stangler and Bell-Masterson (2015) as a starting frame of reference. A quantitative analysis of the largest 150 Metropolitan Statistical Areas (MSAs) in the United States in 2013[3] investigated the indicators associated with entrepreneurial ecosystem vitality using statistical techniques of factor analysis and regression analysis. To answer the first research question (what are the indicators of an entrepreneurial ecosystem, and which of these best reflect the ecosystem's vibrancy), two-factor analyses were conducted. The purpose of these two-factor analyses was to first empirically evaluate the framework established by Stangler and Bell-Masterson "as is" and then to expand the framework to include information from interviews and from the literature review.

To answer the second research question, as to the what indicators of entrepreneurial ecosystems are most valuable for entrepreneurs, we interviewed 31 entrepreneurs in

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[1] This study was prepared with financial support from the Ewing Marion Kauffman Foundation. All contents of this study reflect the views of the grantee and do not reflect the views of Ewing Marion Kauffman Foundation.

[2] There are two major concepts used in this study, and it is important to delineate the difference between a measure and an indicator. In this context, a measure is the operationalization of an idea using databases to discretely quantify the idea. An indicator refers to a grouping of measures which represent a broader concept. This naming convention follows that of the authors Stangler and Bell-Masterson in their framework (Figure A1).

[3] See Appendix A for a listing of MSAs.

Northeast Ohio. This information was used to qualitatively assess the framework and provide inputs for the second factor analysis.

EXAMINATION OF ENTREPRENEURIAL ECOSYSTEMS

The research began with empirically evaluating the framework established within "Measuring an Entrepreneurial Ecosystem" by Stangler and Bell-Masterson (2015) (Figure A1). Stangler and Bell-Masterson provided a theoretical framework for entrepreneurial ecosystem vibrancy and identified 12 measures across four indicators; however, our empirical research concluded that the 12 measures are correct, but that they better align within two main indicators—rather than four. We have renamed these indicators *Opportunity & Access* and *Dense Dynamic Markets*.

Figure A 1. Entrepreneurial Ecosystem Vibrancy

Indicator	Measure	Possible Sources
 DENSITY	New and young firms per 1,000 people	Census Bureau, Business Dynamics Statistics (BDS)
	Share of employment in new and young firms	Census Bureau, BDS
	Sector density, especially high tech	National Establishment Time Series (NETS)
 FLUIDITY	Population flux	Internal Revenue Service
	Labor market reallocation	Quarterly Workforce Indicators (QWI)
	High-growth firms	Inc. 5000 and NETS
 CONNECTIVITY	Program connectivity	Under development
	Spinoff rate	Possibly: CrunchBase; LinkedIn
	Dealmaker networks	Private databases, including Capital IQ
 DIVERSITY	Multiple economic specializations	Quarterly Census of Employment and Wages (QCEW)
	Mobility	Equality of Opportunity project
	Immigrants	American Community Survey (ACS)

Source: Stangler and Bell-Masterson (2015) p. 2

To answer the second research question regarding the most valuable indicators for entrepreneurs, a literature search was completed and interviews conducted with 31 entrepreneurs in Northeast Ohio. Interviews revealed that *density* and *connectivity* were the two indicators within the Stangler and Bell-Masterson framework that were most meaningful from the entrepreneurs' perspectives. Here, *density* references the number of new and young companies, their employment level, and the extent to which those companies function in similar sectors. Entrepreneurs value *density* because it brings "a sense of energy" and gives entrepreneurs "confidence to see that others have done it." *Connectivity* is defined as the "connections between the elements" of an entrepreneurial ecosystem. Interviews confirmed that connections matter because they help entrepreneurs solve problems, find talent, attract funding, build relationships that translate into customers, and innovate. Furthermore, entrepreneurs noted that secondary education and business environments are also critical for ecosystem vibrancy.

At the end of the assessment of interviews and literature review, the research highlighted a total of 12 measures, five of which carried over from the original framework. Another three were modified from the original framework (*connectivity: quality of network*, *traded industries*, and *university presence*), and four new measures were created (*bachelor's degree attainment*, *business environment*, *entrepreneurial finance*, and *patents*). In all, the second factor analysis revealed that there were three major indicators that contributed to a vibrant entrepreneurial ecosystem; we have named these indicators *Innovation*, *Centers of Commerce*, and *Small Business Hubs* (Table A1).[4] It is important to note that the measure "*connectivity*: *quality of network*" was not associated with any indicator in the quantitative analysis.

Table A 1. Indicators of Vibrant Entrepreneurial Ecosystem – Enhanced Framework

Indicator	Measure
Innovation	Patents
	Bachelor's Degree Attainment
	Entrepreneurial Finance
	High-Tech Density
	Traded Industries
Centers of Commerce	High-Growth Firms
	University Presence
	Business Environment
	Immigrants
Small Business Hubs	Share of Employment in New & Young Firms
	Population Flux

Note: Ranked highest to lowest of importance to indicator
Measures that did not associate with any indicator: *Connectivity: Quality of Network*

The *Innovation* indicator displays importance to the measures of *patents*, *bachelor's degree attainment*, *entrepreneurial finance*, *high-tech density*, and *traded industries*. Metropolitan Statistical Areas (MSAs) with high activity in this indicator were large metropolitan areas in the western United States: MSAs already known for their entrepreneurial ecosystems and research universities. *Centers of Commerce* is the second indicator, with the measures of *high-growth firms*, *university presence*, *business environment*, and *immigrants*. Metropolitan areas that showed high activity in this indicator were large, globally-oriented regions with high business costs, expensive rents, prominent research universities, and large foreign-born populations. The last indicator, *Small Business Hubs*, is defined by the share of employment in new and young firms and population flux.

[4] See Appendix B for construction of the measure and data sources.

NEXT STEPS FOR REGIONS

Overall, this research revealed that entrepreneurial ecosystems consist of a complicated mix of regional system assets. Incorporating regional innovation measures as a component of entrepreneurial ecosystems is key, since many of the indicators describing support for entrepreneurship also describe activities fostering innovation—such as research and development, startup financing, and research at universities.

The research also revealed variability of entrepreneurial ecosystem measures by metropolitan area. This research focused on the largest 150 metropolitan areas as a cohort ranging in population from 20 million to 300,000. The largest ten metropolitan areas, places like New York City and Chicago, displayed different indicators than smaller MSAs. This is attributed to the fact that major indicators of entrepreneurial ecosystems are driven by assets found in large urban areas. This, however, does not preclude small MSAs in rural areas from having their own entrepreneurial ecosystems built upon different assets than those of larger regions. Regions behave differently and contain different assets that can be expanded and enhanced to foster their unique entrepreneurial ecosystems' vitality.

The identification of entrepreneurial ecosystem measures means that your community's foundation, capital providers, chambers of commerce, local government, economic development organizations, universities, and incubators can now all have a common understanding of how vibrant your ecosystem is and a common language to talk about your strategy for entrepreneurial support.

There are three ways how practitioners can use this research:

1. Measure your entrepreneurial ecosystem and compare results with other similar regions around the country
2. Use the positive results to complement your marketing communications content
3. Examine the measures that contribute to entrepreneurial ecosystem vitality to align development and communication priorities

As communities begin to execute these three steps, more stakeholders will be able to understand, discuss, and communicate the complex drivers of entrepreneurial ecosystem vibrancy.

INTRODUCTION: WHY THIS WORK MATTERS

Over the last decade there has been a strategic shift from studying entrepreneurs strictly as individuals to investigating their relationship with the broader economic system in which they reside. This shift in examination has brought about new interest in entrepreneurial ecosystems. Theoretical frameworks of existing studies have established the necessary indicators of these systems (see Isenberg, 2011; Stangler and Bell-Masterson, 2015); however, little quantitative research has been conducted on the indicators that lead to measuring ecosystem system success.

Examining entrepreneurial ecosystem measurement is interesting and important research for several reasons. First, there is a significant amount of taxpayer investment through the public financing of small businesses and early stage companies. It is estimated that in FY 2011, the U.S. government spent almost $2 billion on entrepreneurial and small business support through technical assistance, financial assistance, and government contracting assistance (U.S. Government Accountability Office, 2013). In addition to federal spending, states also enacted programs to assist the fostering of businesses and entreprenuerhsip. In 2012, twenty-two (22) individual states offered early-stage investment tax credits as means of supporting early-stage development or attracting early-stage investment firms (Austrian & Piazza, 2014). In addition, $2 billion of federal money is spent on fostering technology commercialization, which is a mechanism to fuel entrepreneurship (Qian & Haynes, 2014; U.S. Small Business Administration, 2012).

Second, with the emergence of the entrepreneurial ecosystem concept, policy makers and funders find themselves in a search of a rubric to measure performance, thereby informing the design and evolution of the ecosystem. Yet, it has been acknowledged that the definitions of the metrics, approaches to measurement, and access to data present formidable challenges to the creation of such a rubric (Mason & Brown, 2014).

Third, practitioners[5] and funders at the local level seek ways to expand entrepreneurial activity in their communities to increase prosperity. Many look for data to inform the steps taken to better support entrepreneurs. There are many ways in which practitioners commonly use that data, grouping them into three categories: Marketing & Development, Operations, and Governance.

> **Marketing and Development**: Supporting entrepreneurs means helping them with their pressing challenges, which most commonly are access to capital, access to talent, and growth of sales. Providing data on the strengths of the entrepreneurial ecosystem makes it easier to attract additional capital, talent, and customers into the region.

[5] "Practitioners" can include economic development professionals, venture capitalists, universities, chambers, incubators, and accelerators.

Operations: Perhaps one of the most critical responsibility for those fostering economic development is resource allocation. Community leaders need to identify the greatest area of need, and then build an appropriate amount of resources, skills, and capabilities to fill that need. Data regarding the vibrancy of communities provides insights into regions which then informs strategy at the community and the organizational level.

Governance: Managing the entrepreneurial ecosystem is a delicate balancing act. It requires a conversation across many stakeholders including funders, practitioners, academics, policy makers and entrepreneurs regarding what matters. Data regarding the vibrancy of the ecosystem will provide a common language and framework to help diverse stakeholders gain an alignment on strategic priorities.

To fully investigate the intricacies of entrepreneurial ecosystems, this research is framed in context of the white paper, "Measuring an Entrepreneurial Ecosystem" by Stangler and Bell-Masterson (2015). The authors of this paper provided a theoretical framework of entrepreneurial ecosystem vibrancy identifying 12 measures, within four indicators (Figure 1).

Figure 1. Entrepreneurial Ecosystem Vibrancy

Indicator	Measure	Possible Sources
 DENSITY	New and young firms per 1,000 people	Census Bureau, Business Dynamics Statistics (BDS)
	Share of employment in new and young firms	Census Bureau, BDS
	Sector density, especially high tech	National Establishment Time Series (NETS)
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	High-growth firms	Inc. 5000 and NETS
 CONNECTIVITY	Program connectivity	Under development
	Spinoff rate	Possibly: CrunchBase; LinkedIn
	Dealmaker networks	Private databases, including Capital IQ
 DIVERSITY	Multiple economic specializations	Quarterly Census of Employment and Wages (QCEW)
	Mobility	Equality of Opportunity project
	Immigrants	American Community Survey (ACS)

Source: Stangler and Bell-Masterson (2015) p. 2

This study, which furthers the work of Stangler and Bell-Masterson, with support from the Ewing Marion Kauffman Foundation,[6] focuses on two major questions: 1) what are the indicators of an entrepreneurial ecosystem, and which of these best reflect the ecosystem's vibrancy? And 2) what indicators of entrepreneurial ecosystems are most valuable for entrepreneurs?

The goals of this research are to provide practitioners and academics with a concrete and measurable framework for understanding entrepreneurial ecosystems and to assess the indicators driving regional entrepreneurial ecosystems. Through a mixed methods approach, measures of the Stangler and Bell-Masterson framework were quantitatively examined, vetted with entrepreneurs, and then reassessed. This research should serve as a useful guide for practitioners, pointing to indicators important for growing vibrant regional entrepreneurial ecosystems. By focusing on the essential indicators of an entrepreneurial ecosystem, practitioners can engage in "intelligent benchmarking" (Malecki, 2007). At the same time, this framework should not be used as a ranking system of regions; this can potentially narrow the focus and sabotage nascent work within communities building ecosystems (Cortright & Mayer, 2004). This research looks to aid regions in benchmarking and tracking the progress of entrepreneurial ecosystem formation and development.

[6] This study was prepared with financial support from the Ewing Marion Kauffman Foundation. All contents of this study reflect the views of the grantee and do not reflect the views of Ewing Marion Kauffman Foundation.

METHODOLOGY

It is important to first delineate the difference between two major concepts used in this study: a "measure" and an "indicator." In this context, a measure is the operationalization of an idea using databases to discretely quantify the idea. An indicator refers to a grouping of measures—which represents a broader concept. This naming convention follows that of the original Stangler and Bell-Masterson framework (Figure 1).

A mixed methods approach was used to answer research questions posited. First, the Stangler and Bell-Masterson framework was operationalized and a factor analysis conducted to quantitatively determine the underlying indicators of entrepreneurial ecosystem vitality. Factor analysis is a statistical data reduction technique where measures are used to represent information via data and are correlated with like measures to reveal the indicators that are most important. This technique can help researchers understand the underlying indicators of large amounts of data. In addition, the association between the indicators derived from the factor analysis and economic output was evaluated (Eberts, Erickcek, and Kleinhenz, 2006). For this study, we used four output measures: *employment*, *gross regional product*, *productivity* (gross regional product per employee), and *per capita income*. This study examined the largest 150 Metropolitan Statistical Areas (MSAs) in the United States in 2013.[7]

Second, researchers interviewed 31 entrepreneurs in Northeast Ohio to ascertain what indicators entrepreneurs viewed as essential for entrepreneurial ecosystem vibrancy. Entrepreneurs were asked to discuss the Stangler and Bell-Masterson framework in light of their own experience. The interviews' objective was to glean the entrepreneurs' perspectives on which indicators of the entrepreneurial ecosystem are most valuable—both for them personally and for regional economic prosperity (reflected in the models with the measures of *gross regional product*, *per capita income*, *employment*, and *productivity*). The research team presented the interviewee with the Stangler and Bell-Masterson framework of entrepreneurial ecosystem vibrancy (Figure 1) and asked three questions:

1. What are your thoughts on the indicators presented in the framework?
2. Would you describe each indicator as an important contributor to, predictor, or requirement for your success?
3. How would you improve the framework? What would you add, subtract, or change?

The rationale for the interviews was to develop an "on the ground" perspective as to what individual entrepreneurs feel matters most. The intention was for the interviews to provide insights on the current landscape of entrepreneurial ecosystems as relevant to practitioners. These insights allowed the research team to vet concepts in the existing framework, identify new and different indicators to be incorporated in the framework, place emphasis on the

[7] See Appendix A for a listing of MSAs.

concepts which mattered most, and include personal narratives that can provide practitioners with useful case studies.

Third, taking into consideration takeaways from the interviews and the literature, the framework was modified and a second factor analysis was conducted. This was followed by regression analysis testing the association between discerned indicators of vibrant entrepreneurial ecosystem and regional economic outcomes. Thus, this research modifies a framework of entrepreneurial ecosystem vitality and uncovers its association with regional economic outcomes.

Fourth, given the challenges related to data collection, the team also chose to investigate innovative measurement techniques of many important entrepreneurial ecosystems topics. The process employed was to search for, measure, and examine new techniques of collecting data for entrepreneurial ecosystem measures. The team searched the web for online data sources, then developed a structure within which to categorize the data discovered. Finally, data was collected and applied to compare the Cleveland-Elyria, OH metropolitan area to the Austin-Round Rock, TX metropolitan area.

PHASE I: EMPIRICALLY EXAMINING ENTREPRENEURIAL ECOSYSTEMS

In this first phase, statistical analysis was completed against the twelve measures and four indicators of the Stangler and Bell-Masterson framework. The intent was to discover how the twelve measures to describe entrepreneurial ecosystem vitality aligned for the largest 150 metropolitan areas in the United States, and to use this information to lay the foundation for an expanded framework.

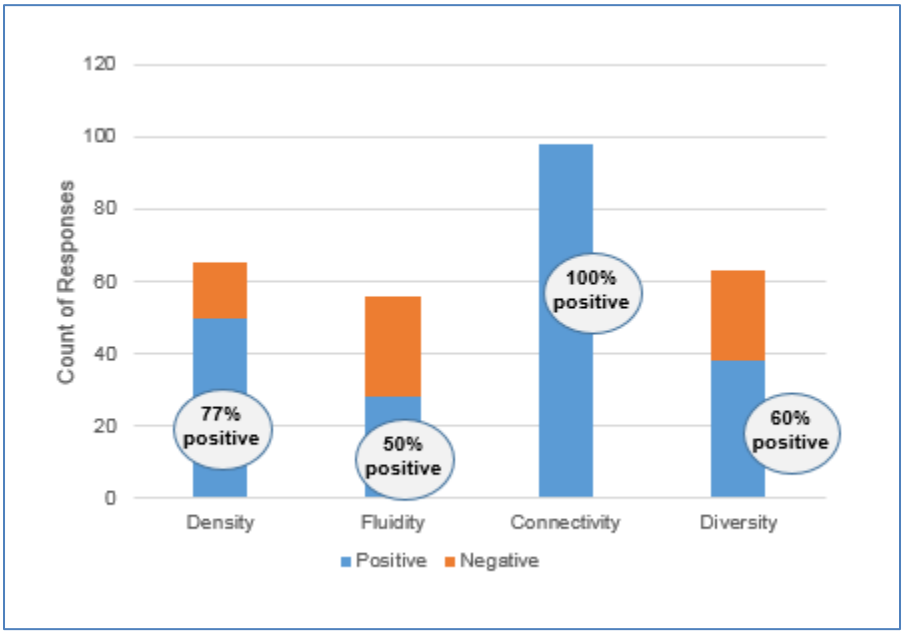
The result of this step was that the analysis grouped the measures into two new indicators. We named these indicators *Opportunity & Access* and *Dense Dynamic Markets*. Furthermore, three measures from the Stangler and Bell-Masterson framework that did not associate with any indicators were *labor market reallocation*, *program connectivity*, and *multiple economic specializations*. Therefore, these three measures were removed from further analysis.

PHASE II: EXPANDING ENTREPRENEURIAL ECOSYSTEM MEASUREMENT

INTERVIEWS WITH ENTREPRENEURS

To complement the Phase 1 analysis, the research team conducted a qualitative analysis of metrics. Across 31 interviews, a total of 282 distinct comments were captured and tabulated by their positive (in support of the concept as an important contributor to success) or negative nature. Figure 2 displays the responses by interviewees to four main indicators as defined by Stangler and Bell-Masterson: *density*, *fluidity*, *connectivity*, and *diversity*. Overall, *density* and *connectivity* are both considered to be strong and important elements reflecting ecosystem vibrancy. Entrepreneurs spoke consistently about the benefits of these two attributes to their growth and vitality of entrepreneurial ecosystems. *Connectivity* stood out among the rest, both by eliciting unanimous positive support from entrepreneurs, and provoking a significant amount of discussion as compared to other categories. Interestingly, *fluidity* and *diversity* were more controversial. *Fluidity* was least positive, with half of comments in favor of this family of metrics, followed by *diversity* with 60% of entrepreneurs considering it as an important factor contributing to the entrepreneurial system vibrancy.

Figure 2. Count of Distinct Qualitative Comments from Entrepreneur Interviews



Density. Defined by Stangler and Bell-Masterson as the number of new and young companies in a given area coupled with their employment level and distinguished by industry affiliation, the reason *density* is so important is that it represents and creates momentum; several entrepreneurs indicated it brings "a sense of energy" and gives them "confidence to see that others have done it." This idea—that a previous entrepreneur has achieved success in a given region—is an indication to potential entrepreneurs that opportunities exist. In addition, this

successful entrepreneur can then act as a champion of the entrepreneurship cause to the larger regional audience.

For example, one entrepreneur spoke about how density was a key success for talent recruitment; Gary, the leader of a materials company, said, "We only have 16 people... One of the biggest problems we face is recruiting top talent, because in a startup there is less job security, and fewer benefits. I have found that it is much easier to find people that are willing to work for a small company like ours in areas that are rich with entrepreneurial firms. In these kinds of areas, such as the one here in Northeast Ohio, good jobs are more plentiful. That makes it not as scary for talented people to join companies like ours." Gary found that talented people are more likely to join his organization if they see others joining similar entrepreneurial ventures.

100% of entrepreneurs say *connectivity* is important

Connectivity. Stangler and Bell-Masterson assert that "the connections between the elements (of a vibrant entrepreneurial ecosystem) matter just as much as the elements themselves." (p. 4). *Connectivity* matters to entrepreneurs because it helps them solve problems, find talent, attract funding, and build the relationships that translate into customers and product innovation.

Mike is the CEO and head of strategy for a marketing technology company and discussed the importance of connecting to peers to learn from others as he **makes business decisions**. "This is the most important driver by 10x fold. We need peers that are slightly ahead of where we are… they can show us what is going to happen in the next couple months. That peer connectivity, it is about having regular conversations (with others) that are in similar stages to you. I have an 8-person peer group. I just bounced stuff off of John, and it changed what that group brought. I get at least 5-6 opinions per month. Need multiple conversations per month."

Andy, CEO of an advanced materials company, explained how connectivity helps with problem solving. He said that connecting with networks helps him **fill in skill gaps**. "A lot of the business that gets done, the problem solving, you can't do it all. You're normally coming in with a partially complete management team that has expertise in either the market sector or a tech expertise, but they don't have everything. So being able to build that network and fill in the gaps that are needed…those networks and connections are critical."

The connectivity in the ecosystem helped one device manufacturer **access capital**. Gordon, the leader of an information technology company, cited 3 examples of formal connectivity structures that contributed to his company's success:

1. an assigned entrepreneur-in-residence helped tell his story, which led to winning $300,000 in pitch competitions and helped start to build the product ("and to our credit, we listened to him");

2. a mentoring program connected Gordon with a "tailor made" mentor who helped him do what he needed to do: quit his job, launch the project and tackle issues of attracting funding;
3. initial funding from JumpStart, Inc. later manifested into a different $3 million investment.

Fluidity. Stangler and Bell-Masterson use the term *fluidity* to reference the (re)allocation of people and resources; there was mixed reaction regarding the importance of *fluidity* among interviewees. Tony, the leader of a drug development company, pointed out that in his experience, the level of *fluidity*, and thus its value for hiring, varied by geography. In Philadelphia, PA, fluidity was significant and useful. For example, Tony called on colleagues at major pharmaceutical companies across the country, and successfully recruited new talent. "In Philadelphia, it was easy to get people from anywhere, I was able to recruit from all over the country." He had the opposite experience in Shreveport, LA, where fluidity was extremely limited. "I knew there was no way…there was no way people would come into the region." Finally, in Cleveland, OH, Tony found a middle ground. "Cleveland was interesting, my colleagues on [the] East and West coast said no, they would not move to the region, but colleagues from companies from Midwest, Chicago, if opportunity was right they would move into the region. That was an important reason for us to move to Cleveland. The ability to import management from Michigan and Missouri was a huge advantage." The implication is that the **(re)allocation of people across geography matters**, and it may be that the greater the movement of people, the greater the value to the entrepreneur.

The opposing view was that many entrepreneurs simply do not see a lot of movement of people either across sectors or geographically (within or across regions). Furthermore, given the rise in connectivity and "fewer boundaries" many don't see the necessity for geographic relocation.

Diversity. In Stangler and Bell-Masterson, *diversity* includes *economic diversification*, *immigration*, and *income mobility*. Entrepreneurs interviewed also had mixed views regarding *diversity*. For many, the initial reaction is that *of course* diversity matters, as a given intrinsic value: "It's the wellspring for entrepreneurship," as one entrepreneur noted. Another explained that diversity of sectors is an "indicator of a vibrant area." Yet, there were few specific examples of how entrepreneurs benefited from this indicator, and in some cases entrepreneurs did not agree with these measures. It is important to note that diversity is a well-established element in fostering entrepreneurship in the literature (Stangler & Wiens, 2015). The limited pool of interviews might not reflect a representative opinion in regard of this indicator.

Laura is the CEO of an insurance company and an immigrant to the U.S.; she explained the value of foreign-born talent, saying, "The thing about moving countries and picking up and moving your life and fitting into someone's culture is that it brings a mindset that lends itself to entrepreneurship. You're not used to being in the mainstream and having to build from scratch. This gives you a certain attitude that you can't be stopped and you will get over adversity." Yet we also heard from Tim, a leader of a business-to-business medical imaging company, who was

ambivalent about seeking out foreign-born workers. “At a high level, the value is relatively small. I am generally looking for folks who are highly educated in my industry, and I don’t care if they are an immigrant or local with a Ph.D.”

The value of *economic mobility* was also mixed. Most positive comments focused on the fact that the promise of economic mobility helps attract talent to a region; as one interviewee commented, “Economic mobility means they can work their way to the top. It attracts talent to the region, which you need to be successful." However, no specific examples of how this measure benefited entrepreneurs emerged from the interviews.

Likewise, comments surrounding the *industry specialization* measure was mixed. Said Gabriel, a leader from a strategic management company, “Clusters are valuable if you are in a cluster.” He suggested that clusters are important only to firms who need to be co-located with other firms as a part of their business model.

New measures. Entrepreneurs also helped identify four (4) new measures for the statistical analysis. The first additional measure is *bachelor’s degree attainment*. The presence of individuals with a bachelor’s degree translates directly to more ease in finding the talent that entrepreneurs need. Jim, who leads a voice recognition technology company, said that “Talent coming out of universities is important especially when you are dealing with technology.”

The second new measure was the cost of doing business*,* or “*business environment.*” Relatively low costs of doing business, such as rent and salaries, also reduce the barriers to entry and make it easier to succeed. Innovation was considered an important driver of entrepreneurship; therefore, *patents* were added as a proxy for innovation.

Finally, the fourth new measure was start-up capital raised, or *“entrepreneurial finance.”* This was an especially interesting measure because entrepreneurs not only highlighted the absolute value of the start-up capital, but also the importance of the source and distribution of the capital. Sources that include a “mix of private and public funding” and “broad distribution” were deemed critical. Gordon explained that limited sources and too narrow a distribution landscape are harmful: “They (investors) are good at getting money, but do a poor job at distributing money, and therefore do a disservice. They create an oligopoly. Unless you play by rules, and ridiculous outdated antiquated terms that you don’t see on the coasts—here it causes stagnation, and anti-fluidity.”

Table 1 displays the combined measures from the Stangler and Bell-Masterson framework, information gleaned from interviews, and the literature review. Overall, many of the themes omitted in the Stangler and Bell-Masterson framework were reiterated through the entrepreneur interviews and the literature review. However, there were a few themes not included in the Stangler and Bell-Masterson framework—such as *business environment*, *entrepreneurial finance*, *bachelor’s degree attainment*, and *patents* (as a proxy for innovation).

Table 1. Measures of Entreprenurial Ecosystem Vibrancy

Measure	Stangler & Bell-Masterson (2015)	Interviews of Entrepreneurs	Literature on Entrepreneurship
Business Environment		√	√
Connectivity (Program Connectivity)	√	√	√
Dealmaker Networks	√	√	
Mobility	√		
Entrepreneurial Finance		√	√
High-growth Firms	√	√	√
High-tech Density (Sector Density)	√	√	√
Immigrants	√	√	√
Bachelor's Degree Attainment		√	√
Industry Clusters		√	√
Patents		√	√
Labor Market Reallocation	√		
Multiple Economic Specializations	√		
New and Young Firms	√	√	√
Population Flux	√	√	
Share of Employment	√		
Spinoff Rate	√		
University Presence		√	√

Note: Original terms from Stangler and Bell-Masterson are in parentheses if term was changed

Table 2 displays the measures used for a second-round analysis of entrepreneurial ecosystems including combined measures from the Stangler and Bell-Masterson framework, interviews, and literature review. It is important to note that the interviews and literature review not only contributed to adding measures but also refined the way measures were quantified which did not associate with either of the two indicators in the first analysis. For example, *labor market reallocation* was not associated with either indicator (*Opportunity & Access* or *Dense Dynamic Markets*) in the first analysis; however, interviewees emphasized an educated workforce and talent attraction as drivers of entrepreneurial growth. Therefore, the measure of *bachelor's degree attainment* was added *and labor market reallocatio*n removed from the second analysis. In addition, neither interviewees nor the literature discussed *spinoff rate*, but both did discuss the importance of universities as drivers of innovation and technology. Thus, these measures were modified.

It is important to point out that—although the measure of *connectivity of entrepreneurial and innovation organizations* did not associate with any indicator in the Stangler and Bell-Masterson framework—*connectivity* was cited in both the interviews and the literature as extremely important. Lack of concrete quantification of the concept of "connectivity" contributed to measurement error and the lack of association of the measure *connectivity of entrepreneurial and innovation organizations* with any indicator in the first analysis. Therefore, the subsequent iteration of the analysis quantified connectivity conceptually as the quality of the network; this modification was made due to data availability and accuracy of measurement (Feldman & Zoller, 2012). For more information on measures used and operationalization of these terms, see Appendix B.

Table 2. Measures of Expanded Framework

Measure
Bachelor's Degree Attainment
Business Environment
Connectivity: Quality of Network
Immigrants
High-Growth Firms
High-Tech Density
Patents
Population Flux
Share of Employment in New & Young Firms
Entrepreneurial Finance
Traded Industries
University Presence

At the end of this phase, the research highlighted a total of 12 measures, five of which carried over from the original framework—three of which were modified from the original framework (*connectivity: quality of network*, *traded industries*, and *university presence*)—as well as four new measures (*bachelor's degree attainment*, *business environment*, *entrepreneurial finance*, and *patents*).

PHASE III: INDICATORS OF VIBRANT ENTREPRENEURIAL ECOSYSTEM

The study defined the expanded pool of indicators describing entrepreneurial ecosystem vibrancy based upon the Stangler and Bell-Masterson framework, entrepreneurial interviews and the literature review. The final step in the process was to synthesize insights from entrepreneur interviews and the literature review, and to modify and expand the framework. In this model, three distinct indicators contribute to entrepreneurial ecosystem vibrancy for the largest 150 metropolitan areas in the United States.

The first indicator of entrepreneurial ecosystem vibrancy is *Innovation*. The *Innovation* indicator is driven by measures of *patents*, *bachelor's degree attainment*, *entrepreneurial finance*, *high-tech density*, and *traded industries* (Table 3). The highest activity in this indicator was found predominantly in large metropolitan areas in the western United States; these MSAs are already known for their entrepreneurial ecosystems and research universities (Table 4). Interestingly, although San Jose, CA (the home of Silicon Valley) has the highest activity for this indicator, five of the ten MSAs with the lowest activity in *Innovation* are also located in California and are considered as agricultural hubs. This demonstrates that proximity of a region to an innovation hub alone is not enough to foster entrepreneurial ecosystem vibrancy; rather, the region must actively engage in innovation activities to increase their entrepreneurial power.

Table 3. Indicators of Vibrant Entrepreneurial Ecosystem – Enhanced Framework

Indicator	Measure
Innovation	Patents Bachelor's Degree Attainment Entrepreneurial Finance High-Tech Density Traded Industries
Centers of Commerce	High-Growth Firms University Presence Business Environment Immigrants
Small Business Hubs	Share of Employment in New & Young Firms Population Flux

Note: Ranked highest to lowest of importance to indicator
Measures that did not associate with any indicator: *Connectivity*: Quality of Network

Centers of Commerce is the term selected for the second indicator, associated with the measures *high-growth firms*, *university presence*, *business environment*, and *immigrants*. Metropolitan areas that showed high activity in this indicator were mostly large global regions with high business costs, expensive rents, prominent research universities, and a large foreign-born population. Areas that displayed low activity on this indicator were the inverse of the *Innovation* indicator—smaller metropolitan areas without large research universities. Finally, the *Small Business Hubs* indicator described the *share of employment in new and young firms and population flux*. Regions that demonstrated high activity in the indicator were in regions in the southern United states, while areas with low activity on the factor were areas in the Midwest.

Table 4. Enhanced Framework - MSAs with High and Low Activity in Indicator

	Innovation	Centers of Commerce	Small Business Hubs
High Activity in Indicator	1. San Jose-Sunnyvale, CA 2. San Francisco-Oakland, CA 3. Austin-Round Rock, TX 4. Raleigh, NC 5. Boston-Cambridge, MA-NH 6. Denver, CO 7. Provo-Orem, UT 8. Durham-Chapel Hill, NC 9. Ann Arbor, MI 10. Seattle-Tacoma, WA	1. New York-Newark, NY-NJ-PA 2. Los Angeles-Long Beach, CA 3. Chicago-Naperville, IL-IN-WI 4. Washington, DC-VA-MD-WV 5. San Francisco-Oakland-, CA 6. Miami-Fort Lauderdale, FL 7. Boston-Cambridge, MA-NH 8. Philadelphia, PA-NJ-DE-MD 9. San Jose-Sunnyvale, CA 10. San Diego-Carlsbad, CA	1. Naples-Immokalee, FL 2. North Port-Sarasota, FL 3. Cape Coral-Fort Myers, FL 4. Austin-Round Rock, TX 5. Miami-Fort Lauderdale, FL 6. Port St. Lucie, FL 7. McAllen, TX 8. Las Vegas-Henderson, NV 9. Myrtle Beach, SC-NC 10. Raleigh, NC
Low Activity in Indicator	141. Huntington, WV-KY-OH 142. Killeen-Temple, TX 143. El Paso, TX 144. Stockton-Lodi, CA 145. Fresno, CA 146. Modesto, CA 147. Bakersfield, CA 148. Brownsville-Harlingen, TX 149. Visalia-Porterville, CA 150. McAllen, TX	141. Ogden-Clearfield, UT 142. Lafayette, LA 143. Eugene, OR 144. Colorado Springs, CO 145. Springfield, MO 146. Myrtle Beach, SC-NC 147. Raleigh, NC 148. Asheville, NC 149. Des Moines, IA 150. Boise City, ID	141. Dayton, OH 142. Pittsburgh, PA 143. Lancaster, PA 144. Syracuse, NY 145. Springfield, MA 146. Milwaukee, WI 147. York-Hanover, PA 148. Rockford, IL 149. Davenport IL 150. Peoria, IL

Note: Some MSA names are abbreviated; for full name see Appendix A

The indicator *Innovation* is strongly associated with productivity and per capita income

Table 5 displays the ranking of entrepreneurial ecosystems' influence on regional growth measures. In order to help grow economies and increase regional prosperity, it is important to assess the contribution of the indicators for entrepreneurship. Rankings are listed only for indicators which showed a statistically significant association between the indicator and the economic growth measures. If there is no ranking in the table, then this indicator did not have an association to the economic growth measure.

The *Innovation* indicator is strongly associated with productivity and per capita income. The *Centers of Commerce* indicator, on the other hand, is strongly associated with the measures of *employment* and *gross regional product*. There was no association between *Small Business Hubs* and measures of regional growth. Although the factor analysis indicated that *Small Business Hubs* was an indicator for explaining entrepreneurial ecosystem vibrancy, the quantitative model did not find a strong enough relationship between this indicator and economic growth measures.

Table 5. Rankings of Entrepreneurial Ecosystem Indicators to Economic Growth

Indicator	Employment	Gross Regional Product	Productivity	Per Capita Income
Innovation		2	1	1
Centers of Commerce	1	1	2	2
Small Business Hubs				

Note: Lack of ranking indicates no association between indicator and regional growth measure; economic growth measures collected for 2013.

LOOKING TOWARD THE FUTURE

This research made significant progress in quantifying previously theoretical concepts—*density*, *connectivity*, *fluidity*, and *diversity*—as they relate to indicators contributing to entrepreneurial ecosystem vitality. Gains were made in the operationalization of measures with data, finding credible data sources for regional comparison, and exploring how quantified measures cluster in indicators and associate with regional economic outcomes. However, this work should be continued with refining the definitions of measures through better data and the conducting of further analyses.

The investigation of indicators describing the vitality of entrepreneurial ecosystems is only as viable as the research inputs. Early in the design of this study, the research team theorized that data collection behind "fuzzy" concepts such as *density*, *fluidity*, *connectivity*, and *diversity* would be difficult (Markusen, 1999). There were three main concerns:

1. **Data availability:** The research team thought that desired data may not be accessible – not only for the team doing the analysis, but also for community leaders who are the direct beneficiaries of the data.
2. **Timeliness of data:** It was thought that even if the data was accessible, it may be outdated or produced at a slower rate. The lack of timeliness would cause issues for determining activity in regions based on current economic conditions.
3. **New and different:** the proposed methodology may inhibit the team from discovering new and different kinds of data elements and sources.

To address these challenges, an analysis was conducted to explore additional data sources, with the intention of focusing on social and mentoring websites. Table 6 displays a listing of the 14-different social and mentoring websites which were identified, prioritized, and screened. Overall, only six sites had mineable data.

Unfortunately, no websites were found to have mineable data available at feasible costs for public analysis; this step revealed that there is currently a significant barrier to entry for new organizations or communities to begin online data collection. However, an organization can also develop their own measures for tracking entrepreneurial ecosystem vitality in their community.

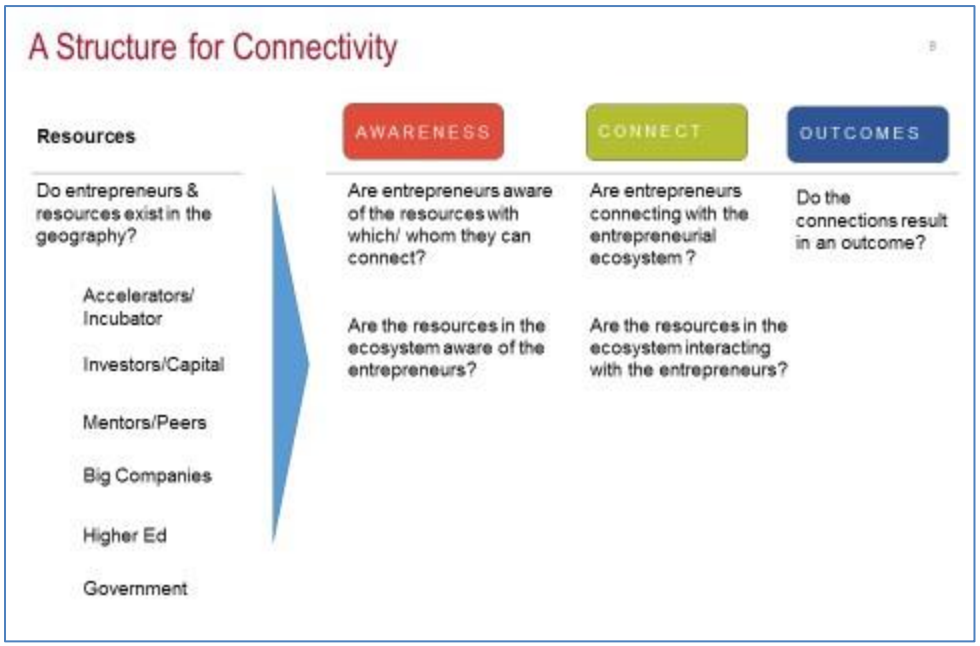
Table 6. Social and Mentoring Websites Reviewed for Data

Priority	Websites	Mineable data
1	Facebook	Yes
2	Twitter	Yes
3	LinkedIn	Yes
4	Mattermark	Yes
5	CrunchBase	Yes
6	PitchBook	Yes
7	Google Plus	No
8	Yahoo!	No
9	Tumblr	No
10	Reddit	No
11	Founders Network	No
12	Kickstarter	No
13	Pinterest	No
14	Instagram	No

With the realization that much of the data from social and mentoring sites was inaccessible, the team chose to expand the list of data to other sources. In addition, the new analysis was prioritized to focus on *connectivity*, since the research indicated that for entrepreneurs, *connectivity* is the most celebrated of categories, yet also the hardest to capture through quantitative assessment.

The data was structured first with a list of resources: *accelerators*, *incubators*, *investors*, *mentors*, *companies*, *higher education*, and *government*. There were three phases of connectivity identified: *Awareness*, *Connections*, and *Outcomes*; Figure 3 lays out this structure. The first phase of connectivity, *awareness*, captures whether the entrepreneur and the resource provider are aware of one another. The second phase of connectivity, *connection*, captures whether the entrepreneur connects with or interacts with the resource, or vice versa. Finally, the third phase captures whether there is an *Outcome* associated with that connection.

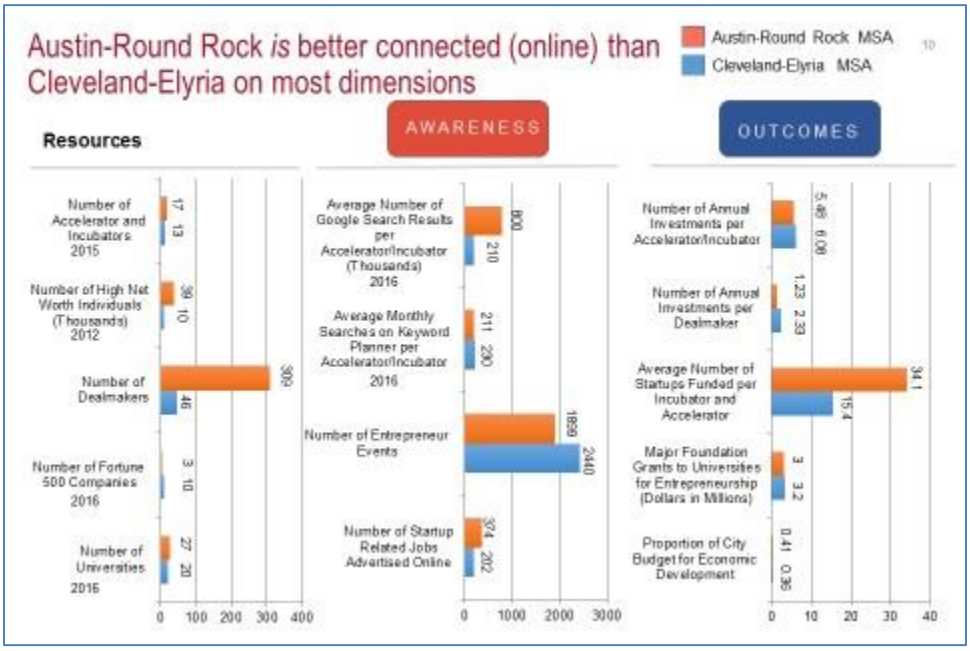
Figure 3. Structure for Connectivity



The team identified multiple online sources that could provide data for each of these framework elements. Items selected were, by necessity, limited to those available for multiple MSAs. For listing of metrics and used in this analysis, see Appendix C.

To test the value of the technique, the team examined several measures in two MSAs: the Cleveland-Elyria, OH MSA (in Northeast Ohio), and Austin-Round Rock, TX MSA. The Cleveland-Elyria MSA was chosen since the research team is familiar with the area. The team compared the Cleveland-Elyria, OH MSA to the Austin-Round Rock, TX MSA because Austin-Round Rock is comparable to Cleveland-Elyria in population (2.1 million people live in the Cleveland-Elyria MSA versus 1.9 million in the Austin-Round Rock MSA) yet scores much higher on the Kauffman Foundations' Startup Activity Index: Cleveland-Elyria is #35, while Austin-Round Rock tops the list at #1 (as of August 2016). Austin-Round Rock's high ranking on the Kauffman Startup Activity Index suggests that Austin-Round Rock has a strong entrepreneurial ecosystem. The research team wanted to know if Austin-Round Rock is better-connected than the Cleveland-Elyria MSA. Figure 4 displays the comparison of connectivity metrics between the two MSAs.

Figure 4. Comparison of Connectivity in Austin-Round Rock MSA and Cleveland-Elyria MSA



Each set of bars in Figure 4 represents the two MSAs' performance in a given measure. Austin-Round Rock does appear to be better connected, at least online, relative to Cleveland-Elyria; Austin-Round Rock is equivalent or greater than the Cleveland-Elyria MSA on most dimensions. Austin-Round Rock's strong connectivity performance (at least compared to Cleveland-Elyria) lends further support to connectivity being an important driver for entrepreneurship.

There is one surprising dimension in which Austin-Round Rock underperforms: the number of entrepreneur events that were advertised, which was much greater in Cleveland-Elyria. This suggests that on this one metric Austin-Round Rock is not as well connected as Cleveland-Elyria. The data collection technique may explain some of the differential in this instance. To gather this data, the team pulled data from EventBrite and Facebook. EventBrite was selected because it is a popular event management tool in Northeast Ohio, and the team confirmed that it is also used by organizations in Austin. However, it is unclear the extent to which EventBrite is used in Austin-Round Rock; it may be that other tools are more popular.

Connectivity, including awareness of and connection to the people and resources within a community, continues to be a very difficult metric to measure. There is rich data to be sourced across social and networking websites such as Facebook, LinkedIn, and others; however, much of this data is costly and not easily accessible. The potential for further analysis and insight is significant—there appears to be opportunity to be creative in new and different ways to capture data, including partnering with websites and applications which were not fully available for this analysis.

IMPLICATIONS OF THE FINAL FRAMEWORK

Overall, this research sought to inform academics and practitioners as to the important indicators of entrepreneurial ecosystem vitality based upon quantitative and qualitative analyses. There are a few important points of discussion gleaned from this research. First, entrepreneurial ecosystems consist of a complicated mix of regional system assets. Second, connectivity between entrepreneurs and entrepreneurial service providers is an important measure of entrepreneurial ecosystem vitality, although it is difficult to quantify. Third, regional variation in the indicators of entrepreneurial ecosystems can be seen on a variety of levels.

Although the studies on entrepreneurial ecosystems are nascent, the influence of innovation on fostering entrepreneurship is well-regarded in the literature (see Acs & Audretsch, 1998; Audretsch, Weigand, & Weigand, 2002; Mueller, 2007; Qian & Haynes, 2014). Incorporating regional innovation measures as a component of entrepreneurial ecosystem vitality is key since many of the measures that this report indicate help foster entrepreneurship also help foster innovation (such as research and development, startup financing, and research university technology development).

While quantitative analysis did not find *connectivity* to be a measure of entrepreneurial ecosystems, the qualitative assessment of this study points to its importance. The research team learned from many entrepreneurs that connecting with mentors, other entrepreneurs, and financial resources was essential for growth. It is very difficult to quantify the amount and quality of connections between individuals across metropolitan areas; as such, the lack of quantitative findings regarding the measure of *connectivity* may be attributed to measurement error. Some of this work has been undertaken by Motoyama (2014) in his examination of networks and connections within the St. Louis entrepreneurial ecosystem. Beyond this, a conversation among all ecosystem participants regarding the availability of data and measures might facilitate a broader conversation on entrepreneurial ecosystem vitality and available data. It is the hope that with more sophisticated data measurement techniques (e.g. using hashtags, twitter streams, etc.) the possibilities in measuring individuals' and organizational connections can be expanded.

This research focused on the largest 150 metropolitan areas as a cohort ranging in population from 300,000 to 20 million. Due to the variation in size of metropolitan areas, a preliminary investigation into the different indicators of large metropolitan areas versus small metropolitan areas was assessed. The largest ten metropolitan areas, including sites like New York City and Chicago, displayed different indicators than smaller MSAs. This is attributed to the fact that several major indicators within this model of entrepreneurial ecosystem vitality are driven by assets found in large urban areas. This, does not, however, preclude small MSAs and rural areas from having their own entrepreneurial ecosystem model built upon different assets than those of larger cities. Examining the MSA rankings using measures from the *Centers of Commerce* indicator shows high activity in large metropolitan areas (New York City, Chicago, Los Angles) and low activity in small metropolitan areas (Boise, ID; Des Moines, IA; and Ashville, NC). Showing that these small metropolitan areas often do not have as many assets such *high-*

growth firms, *universities*, a strong *business environment*, and *immigrants* as larger metropolitan areas do. Replicating this study with a rural focus would glean different results, as well as different indicators and measures that are specific to rural communities.

This research overall sought to identify key indicators for describing a vibrant entrepreneurial ecosystem and to establish which of these indicators are most valuable for entrepreneurs. The interviews with 31 entrepreneurs across Northeast Ohio revealed that *density* and *connectivity* are the two indicators of the Stangler and Bell-Masterson framework which are most meaningfully productive to entrepreneurs from their own perspectives. In their eyes, *density* brought them "a sense of energy" and "confidence to see that others have done it," while *connectivity* and *connections* mattered to help solve problems, find talent, attract funding, build relationships which translate into customers, and innovate. Looking to the future, there are numerous opportunities for further research to complement this work. For example, more needs to be understood about the role of *connectivity* as it relates to entrepreneurial ecosystems—such as how *connectivity* plays a role as a driver of other measures, as well as how the reciprocity of other indicators strengthens *connectivity* in turn. Perhaps most importantly, there is an opportunity to learn from the data and from each other as communities begin to benchmark performance of entrepreneurial ecosystems and to apply this enhanced framework to their cities and towns.

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APPENDIX

APPENDIX A. COHORT OF MSAS

Akron, OH	Detroit-Warren-Dearborn, MI
Albany-Schenectady-Troy, NY	Durham-Chapel Hill, NC
Albuquerque, NM	El Paso, TX
Allentown-Bethlehem-Easton, PA-NJ	Eugene, OR
Anchorage, AK	Fayetteville, NC
Ann Arbor, MI	Fayetteville-Springdale-Rogers, AR-MO
Asheville, NC	Flint, MI
Atlanta-Sandy Springs-Roswell, GA	Fort Wayne, IN
Augusta-Richmond County, GA-SC	Fresno, CA
Austin-Round Rock, TX	Grand Rapids-Wyoming, MI
Bakersfield, CA	Greensboro-High Point, NC
Baltimore-Columbia-Towson, MD	Greenville-Anderson-Mauldin, SC
Baton Rouge, LA	Gulfport-Biloxi-Pascagoula, MS
Beaumont-Port Arthur, TX	Harrisburg-Carlisle, PA
Birmingham-Hoover, AL	Hartford-West Hartford-East Hartford, CT
Boise City, ID	Hickory-Lenoir-Morganton, NC
Boston-Cambridge-Newton, MA-NH	Houston-The Woodlands-Sugar Land, TX
Bridgeport-Stamford-Norwalk, CT	Huntington-Ashland, WV-KY-OH
Brownsville-Harlingen, TX	Huntsville, AL
Buffalo-Cheektowaga-Niagara Falls, NY	Indianapolis-Carmel-Anderson, IN
Canton-Massillon, OH	Jackson, MS
Cape Coral-Fort Myers, FL	Jacksonville, FL
Charleston-North Charleston, SC	Kansas City, MO-KS
Charlotte-Concord-Gastonia, NC-SC	Killeen-Temple, TX
Chattanooga, TN-GA	Knoxville, TN
Chicago-Naperville-Elgin, IL-IN-WI	Lafayette, LA
Cincinnati, OH-KY-IN	Lakeland-Winter Haven, FL
Cleveland-Elyria, OH	Lancaster, PA
Colorado Springs, CO	Lansing-East Lansing, MI
Columbia, SC	Las Vegas-Henderson-Paradise, NV
Columbus, OH	Lexington-Fayette, KY
Corpus Christi, TX	Little Rock-North Little Rock-Conway, AR
Dallas-Fort Worth-Arlington, TX	Los Angeles-Long Beach-Anaheim, CA
Davenport-Moline-Rock Island, IA-IL	Louisville/Jefferson County, KY-IN
Dayton, OH	Madison, WI
Deltona-Daytona Beach-Ormond Beach, FL	Manchester-Nashua, NH
Denver-Aurora-Lakewood, CO	McAllen-Edinburg-Mission, TX
Des Moines-West Des Moines, IA	Memphis, TN-MS-AR

Note: Listing of 150 MSAs ranked from U.S. Census Bureau American Community Survey Population, 2013

APPENDIX A. COHORT OF MSAS (CONTINUED)

Miami-Fort Lauderdale-West Palm Beach, FL	St. Louis, MO-IL
Milwaukee-Waukesha-West Allis, WI	Salem, OR
Minneapolis-St. Paul-Bloomington, MN-WI	Salinas, CA
Mobile, AL	Salisbury, MD-DE
Modesto, CA	Salt Lake City, UT
Montgomery, AL	San Antonio-New Braunfels, TX
Myrtle Beach-Conway-North Myrtle Beach, SC-NC	San Diego-Carlsbad, CA
Naples-Immokalee-Marco Island, FL	San Francisco-Oakland-Hayward, CA
Nashville-Davidson--Murfreesboro--Franklin, TN	San Jose-Sunnyvale-Santa Clara, CA
New Haven-Milford, CT	Santa Maria-Santa Barbara, CA
New Orleans-Metairie, LA	Santa Rosa, CA
New York-Newark-Jersey City, NY-NJ-PA	Savannah, GA
North Port-Sarasota-Bradenton, FL	Scranton--Wilkes-Barre--Hazleton, PA
Ocala, FL	Seattle-Tacoma-Bellevue, WA
Ogden-Clearfield, UT	Shreveport-Bossier City, LA
Oklahoma City, OK	Spokane-Spokane Valley, WA
Omaha-Council Bluffs, NE-IA	Springfield, MA
Orlando-Kissimmee-Sanford, FL	Springfield, MO
Oxnard-Thousand Oaks-Ventura, CA	Stockton-Lodi, CA
Palm Bay-Melbourne-Titusville, FL	Syracuse, NY
Pensacola-Ferry Pass-Brent, FL	Tallahassee, FL
Peoria, IL	Tampa-St. Petersburg-Clearwater, FL
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	Toledo, OH
Phoenix-Mesa-Scottsdale, AZ	Trenton, NJ
Pittsburgh, PA	Tucson, AZ
Portland-South Portland, ME	Tulsa, OK
Portland-Vancouver-Hillsboro, OR-WA	Urban Honolulu, HI
Port St. Lucie, FL	Vallejo-Fairfield, CA
Providence-Warwick, RI-MA	Virginia Beach-Norfolk-Newport News, VA-NC
Provo-Orem, UT	Visalia-Porterville, CA
Raleigh, NC	Washington-Arlington-Alexandria, DC-VA-MD-WV
Reading, PA	Wichita, KS
Reno, NV	Winston-Salem, NC
Richmond, VA	Worcester, MA-CT
Riverside-San Bernardino-Ontario, CA	York-Hanover, PA
Rochester, NY	Youngstown-Warren-Boardman, OH-PA
Rockford, IL	
Sacramento--Roseville--Arden-Arcade, CA	

Note: Listing of 150 MSAs ranked from U.S. Census Bureau American Community Survey Population, 2013

APPENDIX B. EXPANDED FRAMEWORK – MEASURE, DEFINITIONS, AND SOURCES

Measure	Operationalized	Source	Year
New and young firms per 1,000 people	Number of Firms less than 5 years old / population	U.S. Census BDS; U.S. Census ACS	2013
Share of employment in New and young firms	Employment in firms less than 5 years old / total employment	U.S. Census BDS	2013
Hi-tech density	Number of high-tech companies that are less than 5 years old / population	U.S. Census BDS; U.S. Census ACS; U.S. Bureau of Labor Statistics QCEW	2013
Population flux	Number of people moving in/ number of people moving out	Internal Revenue Service	2013
High-growth firms	Number of Inc. 5,000 companies	Inc.com	2013
Dealmaker networks	Number of unique investors	Crunchbase	2013
Immigrants	Percentage of foreign born	U.S. Census ACS	2013
Traded Industries	Ranking in the top 25% of all regions by specialization and also meeting minimum criteria for employment and establishment	U.S. Cluster Mapping Project	2014
Bachelor's Degree Attainment	Percentage of individuals 25 years or older with a bachelor's degree	ACS	2013
Business Environment	Index computed by Moody's Analytics which includes labor, energy and taxes. A good index to report business costs of a region.	Moody's Analytics	2013
University Presence	3-year average of gross income from licensing	AUTM	2012-2014
Patents	Number of patents issued per 10,000 employees	U.S. PTO; Moody's Analytics	2013
Entrepreneurial Finance	Total amount ($) raised by startups / Private Sector Employment	PitchBook BLS	2016
Connectivity - Quality of Network	3-year average of the number of investments / number of companies	Crunchbase	2012-2014

Abbreviation Notes: ACS= American Community Survey; AUTM=Association of University Technology Managers; BDS= Business Dynamics Statistics; EDA-Economic Development Administration; QCEW=Quarterly Census of Employment and Wages; QWI= Quarterly Workforce Indicators;

APPENDIX C. CONNECTIVITY MEASURES AND SOURCES

Measure	Source
Accelerators/Incubators	PitchBook
Annual Investments per Dealmaker	PitchBook
Average Monthly Searches per Accelerator/Incubator	Google Keyword Planner
Average Number of Startups Funded per Incubator and Accelerator	PitchBook
Dealmaker Networks	PitchBook
Entrepreneur Events	Eventbrite, Facebook
Fortune 500 Companies Headquartered in Region	Google
High-net worth individuals	Internal Revenue Service
Investments per Accelerator/Incubator	PitchBook
Major Foundation Grants to Universities for Entrepreneurship	Google
Number of Google Search Results per Accelerator/Incubator	Google
Number of Startup Related Jobs Advertised Online	Indeed.com
Proportion of City Budget for Economic Development	Google
Universities	Google