Cleveland State University
EngagedScholarship@CSU

Maxine Goodman Levin College of Urban Affairs

Urban Publications | Maxine Goodman Levin College of Urban Affairs

12-2016

# Practitioner Guidebook: Measuring Entrepreneurial Ecosystems

Merissa Piazza
*Cleveland State University*, m.c.piazza83@csuohio.edu

**How does access to this work benefit you? Let us know!**
Follow this and additional works at: http://engagedscholarship.csuohio.edu/urban_facpub

Part of the Urban Studies and Planning Commons

Repository Citation
Piazza, Merissa, "Practitioner Guidebook: Measuring Entrepreneurial Ecosystems" (2016). *Urban Publications*. 0 1 2 3 1453.
http://engagedscholarship.csuohio.edu/urban_facpub/1453

This Report is brought to you for free and open access by the Maxine Goodman Levin College of Urban Affairs at EngagedScholarship@CSU. It has been accepted for inclusion in Urban Publications by an authorized administrator of EngagedScholarship@CSU. For more information, please contact library.es@csuohio.edu.

Maxine Goodman Levin
College of Urban Affairs
Center for Economic Development

Prepared for:
**JumpStart Inc.**
**E.M. Kauffman Foundation**

# PRACTITIONER GUIDEBOOK: MEASURING ENTREPRENEURIAL ECOSYSTEMS

Prepared by:
**Merissa C. Piazza**

December 2016

2121 Euclid Avenue Cleveland, Ohio 44115
http://urban.csuohio.edu

*(This page intentionally left blank)*

## TABLE OF CONTENTS

Introduction ..... 1
Methodology ..... 3
Phase I: Validating the Framework ..... 4
Phase II: Expanding the Framework ..... 6
References ..... 10
Appendix ..... 11
Appendix A. Cohort of MSAs ..... 11
Appendix B. Validating Framework – Measures, Definitions, and Sources ..... 13
Appendix C. Expanded Framework – Measures, Definitions, and Sources ..... 14

## LIST OF TABLES & FIGURES

Figure 1. Entrepreneurial Ecosystem Vibrancy ..... 2
Table 1. Indicators of Vibrant Entrepreneurial Ecosystem – Framework Based on Stangler and Bell-Masterson ..... 4
Table 2. Original Framework - MSAs with High and Low Activity in Indicator ..... 5
Table 3. Rankings of Entrepreneurial Ecosystem Indicators to Economic Growth ..... 5
Table 4. Measures of Entreprenurial Ecosystem Vibrancy ..... 6
Table 5. Measures of Expanded Framework ..... 7
Table 6. Indicators of Vibrant Entrepreneurial Ecosystem – Enhanced Framework ..... 8
Table 7. Enhanced Framework - MSAs with High and Low Activity in Indicator ..... 9
Table 8. Rankings of Entrepreneurial Ecosystem Indicators to Economic Growth ..... 9

# INTRODUCTION

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 a combined $2 billion on entrepreneurial and small business support through technical, financial, 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 entreprenuership. 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 was spent on fostering technology commercialization, which is a mechanism to fuel entrepreneurship (Qian & Haynes, 2014; U.S. Small Business Administration, 2012). Finally, studying the measurement of entrepreneurial ecosystems across regions allows for the understanding of best practices of ecosystem development (Feld, 2012).

In order to investigate entrepreneurial ecosystems, this research is framed in context of the white paper, “Measuring an Entrepreneurial Ecosystem” by Stangler and Bell-Masterson (2015). The authors provide a theoretical framework of entrepreneurial ecosystem vibrancy, identifying 12 measures within four indicators (Figure 1). This study, with support from the Ewing Marion Kauffman Foundation,[1] focuses on two major empirical questions: 1) Does the theoretical model established by Stangler and Bell-Masterson (2015) quantitatively hold for regions? Meaning, when the theoretical model is empirically evaluated, will the same data groupings emerge? and 2) What are the key indicators which entrepreneurs and the economic literature view as essential for entrepreneurial ecosystem vibrancy?

[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.

## 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) |
| 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

The goals of this research are to provide practitioners and academics with a concrete and measurable framework for understanding entrepreneurial ecosystem vibrancy and to assess the indicators driving successful 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.

# METHODOLOGY

A mixed methods approach was used to answer research questions posited. The Stangler and Bell-Masterson framework was operationalized and two-factor analyses conducted to quantitatively determine the underlying indicators of entrepreneurial ecosystems. 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.[2]

First, the author operationalized the Stangler and Bell-Masterson framework and conducted a factor analysis to quantitatively determine the underlying indicators of entrepreneurial ecosystem vitality. In addition, a regression analysis was conducted to assess the association of identified indicators in entrepreneurial ecosystems with measures of economic growth. Second, JumpStart Inc. interviewed 31 entrepreneurs in Northeast Ohio to ascertain what indicators entrepreneurs viewed as essential for entrepreneurial ecosystem vibrancy. Third—taking into consideration takeaways from the interviews—the framework was modified and a second factor analysis and regression analysis conducted.

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 data 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 original Stangler and Bell-Masterson framework (Figure 1).

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

## PHASE I: VALIDATING THE FRAMEWORK

In validating the Stangler and Bell-Masterson framework, the research team engaged in a factor analysis of the existing measures in their model. Table 1 displays the indicators that contribute to entrepreneurial ecosystem vibrancy based upon the first factor analysis. Overall, two distinct indicators contribute to entrepreneurial ecosystem vitality for the largest 150 metropolitan areas in the United States. Based upon our quantitative investigation, there are two main driving indicators of entrepreneurial ecosystems rather than the four (*density*, *fluidity*, *connectivity*, and *diversity*) theorized by the Stangler and Bell-Masterson (2015). These indicators are identified as "*Opportunity & Access*" and "*Dense Dynamic Markets.*" This addresses the first research question of whether the Stangler and Bell-Masterson framework holds for regions.

**Table 1. Indicators of Vibrant Entrepreneurial Ecosystem – Framework Based on Stangler and Bell-Masterson**

| Indicator | Measure |
|---|---|
| Opportunity & Access | High-Growth Firms<br>Dealmaker Networks<br>University Spinoff Rate<br>Immigrants<br>Economic Mobility |
| Dense Dynamic Markets | New and Young Firms per 1,000 People<br>Share of Employment in New & Young Firms<br>High-Tech Density<br>Population Flux |

Note: Measures ranked highest to lowest of importance to indicator;
Measures that did not associate with any indicator: Labor market reallocation, Connectivity of entrepreneurial and innovation organizations, and Multiple economic specializations

*Opportunity and Access*, the indicator which has the largest influence on the overall framework, combines the Stangler and Bell-Masterson indicators of *connectivity* (*dealmaker networks* and *spinoff rate*) and *diversity* (*immigrants* and *economic mobility*). The second indicator, *Dense Dynamic Markets*, on the other hand, mainly consists of Stangler and Bell-Masterson's gauge of density (*new and young firms per 1,000 people*, *share of employment in new and young firms*, and *high-tech density*). For more information on measures used and how they are defined and operationalized, see Appendix B.

The *Opportunity and Access* indicator is associated with measures of *high-growth firms*, *dealmaker networks*, *university spinoff rate*, *immigrants*, and *economic mobility*. Metropolitan areas with high activity in this indicator were regions that can be considered global regions, while those areas with low activity in this indicator were smaller, rural places. Knowing that the first indicator is associated with high-growth firms, deal flow, and universities, larger areas have high activity in these measures because they have larger and more robust economies; therefore, they can create and foster more vibrant entrepreneurial ecosystems (Glaeser, 2012).

Measures associated with the second indicator, *Dense Dynamic Markets*, were *new and young firms*, *share of employment in new and young firms*, *high-tech density*, and *population flux*. Areas that had high activity in this indicator were large metropolitan areas in the South, while MSAs that had low activity in this indicator were in Northern U.S. regions (Table 2). This is an indication of the last twenty-years' economic trends of job growth in the South and a decline in the North. In his 2009 article on Rustbelt cities, Ed Glaeser notes that, "There is no measure that predicts urban population growth in the 20th century better than January temperature."

### Table 2. Original Framework - MSAs with High and Low Activity in Indicator

| | Opportunity & Access | Dense Dynamic Markets |
|---|---|---|
| **High Activity in Indicator** | 1. New York-Newark-Jersey City, NY-NJ-PA | 1. Miami-Fort Lauderdale, FL |
| | 2. San Francisco-Oakland-Hayward, CA | 2. Naples-Immokalee-Marco Island, FL |
| | 3. Boston-Cambridge-Newton, MA-NH | 3. Austin-Round Rock, TX |
| | 4. Los Angeles-Long Beach-Anaheim, CA | 4. North Port-Sarasota-Bradenton, FL |
| | 5. Washington-Arlington, DC-VA-MD-WV | 5. Cape Coral-Fort Myers, FL |
| | 6. San Jose-Sunnyvale-Santa Clara, CA | 6. Raleigh, NC |
| | 7. Chicago-Naperville-Elgin, IL-IN-WI | 7. Denver-Aurora-Lakewood, CO |
| | 8. Philadelphia-Camden, PA-NJ-DE-MD | 8. Las Vegas-Henderson-Paradise, NV |
| | 9. Atlanta-Sandy Springs-Roswell, GA | 9. Lafayette, LA |
| | 10. Seattle-Tacoma-Bellevue, WA | 10. Orlando-Kissimmee-Sanford, FL |
| **Low Activity in Indicator** | 141. Killeen-Temple, TX | 141. Rockford, IL |
| | 142. Deltona-Daytona Beach-Ormond Beach, FL | 142. Canton-Massillon, OH |
| | 143. Portland-South Portland, ME | 143. Lancaster, PA |
| | 144. Gulfport-Biloxi-Pascagoula, MS | 144. Peoria, IL |
| | 145. Augusta-Richmond County, GA-SC | 145. Spokane-Spokane Valley, WA |
| | 146. North Port-Sarasota-Bradenton, FL | 146. Savannah, GA |
| | 147. Fayetteville, NC | 147. Huntington-Ashland, WV-KY-OH |
| | 148. Asheville, NC | 148. Reading, PA |
| | 149. Ocala, FL | 149. Pittsburgh, PA |
| | 150. Myrtle Beach, SC-NC | 150. York-Hanover, PA |

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

The two indicators vary in their influence on regional growth measures. Table 3 depicts each indicator and the rank of its importance to one of four regional growth measures (*employment*, *gross regional product*, *productivity*, and *per capita income*). Interestingly, *Dense Dynamic Markets* are strongly associated with employment and gross regional product, more so than *Opportunity & Access*. However, these rankings are changed in relation to productivity and per capita income, with *Opportunity & Access* showing a stronger association than *Dense Dynamic Markets*.

### Table 3. Rankings of Entrepreneurial Ecosystem Indicators to Economic Growth

| Indicator | Employment | Gross Regional Product | Productivity | Per Capita Income |
|---|---|---|---|---|
| Opportunity & Access | 2 | 2 | 1 | 1 |
| Dense Dynamic Markets | 1 | 1 | 2 | 2 |

Note: Economic growth measures collected for 2013

## PHASE II: EXPANDING THE FRAMEWORK

JumpStart Inc. conducted interviews with 31 entrepreneurs in Northeast Ohio to ascertain their perceptions about essential components of entrepreneurial ecosystems. Researchers presented interviewees with the Stangler and Bell-Masterson (2015) framework and asked them if these were important measures. Researchers also asked what are other important measures of entrepreneurial ecosystem vitality were missing in the provided framework. In addition, Cleveland State University (CSU) examined the literature on entrepreneurial ecosystems, the contribution of entrepreneurship to regional economies, and indicators of entrepreneurship to identify other measures of the regional entrepreneurial ecosystems beyond those included in the Stangler and Bell-Masterson (2015) framework.

Table 4 displays the combined measures from the Stangler and Bell-Masterson framework, interviews conducted by JumpStart Inc., and the CSU literature review. Overall, many of the themes highlighted in the Stangler and Bell-Masterson framework are reiterated within the entrepreneur interviews and the literature review. However, there are some 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 4. 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 | √ | | |

Table 5 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 that measures which did not associate with either of the two indicators in the first analysis were quantified. For example, *labor market*

*reallocation* was not associated with either indicator (*Opportunity & Access* or *Dense Dynamic Markets*) in the first analysis, while interviewees saw an educated workforce and talent attraction as drivers of entrepreneurial growth. Therefore, the measure of *bachelor's degree attainment* was added and *labor market reallocation* removed from the second analysis. In addition, interviewees and the literature did not discuss *spinoff rate*, but did discuss the importance of universities as drivers of innovation and technology. Thus, these measures were modified.

It is important to point out that—while 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 "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 as a quality of the network; this modification was made due to data availability and accuracy of measurement (Feldman & Zoller, 2012). For more information on measures and definitions, see Appendix C.

**Table 5. 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*).

Table 6 presents the indicators that contributed to entrepreneurial ecosystem vibrancy based upon the combined measures 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 6). 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 7). 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 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 6. Indicators of Vibrant Entrepreneurial Ecosystem – Enhanced Framework**

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

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

Table 8 displays the ranking of the three indicators of entrepreneurial ecosystem on regional growth measures. It is important to assess the contribution of the indicators to regional growth measures, since efforts are made to increase entrepreneurship to grow economies and increase regional prosperity. 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 *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 8. 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.

## REFERENCES


Acs, Z. & Audretsch, D. B. (1988). Innovation in Large and Small Firms: An Empirical Analysis. *American Economic Association*. 78 (4). 678-690.

Adretsch, D. B., Weigand, J., & Weigand, C. (2002). The Impact of the SBIR on Creating Entrepreneurial Behavior. *Economic Development Quarterly*, 16(1), 32-38.

Austrian, Z., & Piazza, M. C. (2014). Barriers and opportunities for entrepreneurship in older industrial regions. In W. M. Bowen (Ed.) *The road through the rustbelt* (pp. 215-243). Kalamazoo: W.E. Upjohn Institute for Employment Research.

Cortright, J. & Meyer, H. (2004) Increasingly Rank: the Use and Misuse of Rankings in Economic Development. *Economic Development Quarterly*. 18 (1), 34-39.

Eberts, R., Erickcek, G., & Kleinhenz, J. (2006). *Dashboard Indicators for the Northeast Ohio Economy: Prepared for the Fund for Our Economic Future*. Cleveland, OH: Federal Reserve of Cleveland. Download from http://www.clevelandfed.org/research/workpaper/2006/wp06-05.pdf

Feld, B. (2013). *Startup Communities*. Hoboken, NJ: Wiley

Feldman, M. & Zoller, T. D., (2012). Dealmakers in Place: Social Capital Connections in Regional Entrepreneurial Economies. *Regional Studies*. 46 (1), 23-37.

Glaeser, E. (2012). *Triumph of the City*. New York: Penguin.

Glaeser, E. (2009, February 3). Revenge of the Rust Belt. New York Times. Download from http://economix.blogs.nytimes.com/2009/02/03/revenge-of-the-rust-belt/

Griffiths, M. D., Gundry, L., Kickul, J., & Fernandez, A. M. (2009). Innovation ecology as a precursor to entrepreneurial growth: A cross-country empirical investigation. *Journal of Small Business and Enterprise Development*. 16(3), 375-390.

Isenberg, D. (2011). *The entrepreneurship ecosystem strategy as a new paradigm for economic policy: Principles for Cultivating Entrepreneurship*. Babson Park, Massachusetts: Babson College

Malecki, E. J. (2004). Jockeying for Position: What It Means and Why It Matters to Regional Development Policy When Places Compete. *Regional Studies*, 38(9), 1101-1120

Qian, H. & Haynes, K. (2014). Beyond innovation: the Small Business Innovation Research program as entrepreneurship policy. *Journal of Technology Transfer*. 39 (4), 524-543.

Stangler, J. & Bell-Masterson, J. (2015). *Measuring an Entrepreneurial Ecosystem*. Kansas City, MO: Ewing Marion Kauffman Foundation.

U.S. Government Accountability Office. (2013). *Entrepreneurial assistance: opportunities exist to improve programs' collaboration, data-tracking, and performance management.* GAO-13-452T, Washington, DC. Download from http://www.gao.gov/products/GAO-12-601T

U.S. Small Business Administration. (2012). *The Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR) programs*. Washington, D.C.: U.S. Government. Download from https://www.sbir.gov/sites/default/files/annual_reports/SBIR-STTR_FY_2012_Report_Final.pdf

# 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. VALIDATING FRAMEWORK – MEASURES, DEFINITIONS, AND SOURCES

| Kauffman Indicator | Measure | Operationalized | Year | Source |
|---|---|---|---|---|
| **Density** | New and Young Firms Per 1,000 people | Number of Firms less than 5 years old / population | 2013 | U.S. Census BDS; U.S. Census ACS |
| | Share of Employment in New & Young Firms | Employment in firms less than 5 years old / total employment | 2013 | U.S. Census BDS; |
| | Hi-Tech Density | Number of high-tech companies that are less than 5 years old/population | 2013 | U.S. Census BDS; U.S. Census ACS; U.S. Bureau of Labor Statistics QCEW |
| **Fluidity** | Population flux | Number of people moving in/ number of people moving out | 2013 | Internal Revenue Service |
| | Labor market reallocation | hires/job creation | 2013 | U.S. Census QWI |
| | High-growth firms | Number of Inc. 5,000 companies | 2013 | Inc. |
| **Connectivity** | Connectivity of Entrepreneurial and Innovation Organizations | Number of twitter followers for each entrepreneurial and innovation organization/firms less than 5 years old | 2016 & 2013 | EDA Cluster Mapping Project; Twitter; U.S. Census Business Dynamics Statistics |
| | Spinoff Rate | 3-year average of startup companies at universities or university affiliates | 2012-2014 | Association of University Technology Managers |
| | Dealmaker Networks | Number of unique investors | 2013 | Crunchbase |
| **Diversity** | Multiple Economic Specializations | Number of 4-digit NAICS categories with an employment LQs greater than 1.2 | 2013 | Moody's Analytics |
| | Economic Mobility | Absolute mobility is the expected rank of children from families at any given percentile | Birth Cohorts 1980-1991 | The Equality of Opportunity Project |
| | Immigrants | Percentage of foreign born | 2013 | U.S. Census ACS |

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. EXPANDED FRAMEWORK – MEASURES, 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 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 |
| Start-up Capital | 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;