

Connective Development: Recognizing the Networked City in Forming a Progressive Urban Economic Development Strategy

By

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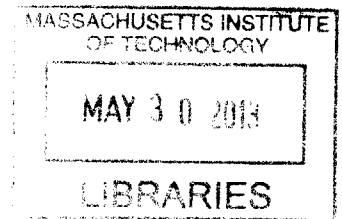
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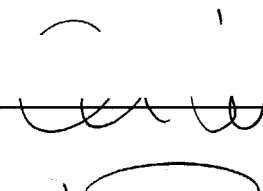
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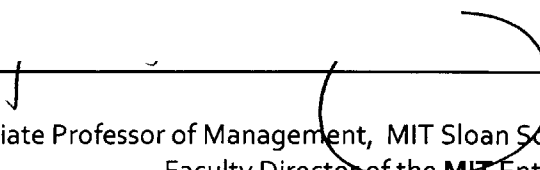
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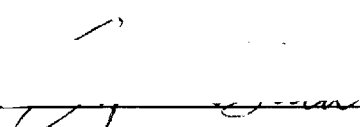
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ABSTRACT

The architecture of the economy is in rapid transformation.¹ As the innovation economy is the most influential segment of the economy because it creates a ripple of value throughout the broader economy, successful efforts to accelerate innovation will have the greatest overall effect. However, these innovation actors are no longer located in just one geographical location, and the money and resources that support their endeavors are spread across multiple cities, and are continually moving between them. Increasingly today, connectivity occurs both regionally (in innovation hubs and their satellite cities) and meta-regionally (between cities not geographically proximate), and few formal policy frameworks exist to support these expanded geographic networks. Lead institutional and corporate anchors in urban markets are not effectively engaged in this dispersed economic system, further constraining growth. Current Economic Development policies have been unable to catalyze and sustain a period of real sustained growth as they are outdated, restrained by a narrow political lens, subject to regional competition, or locked in a federal policy with little financial strength to do anything impactful. Missing is a layer of meaningful connective infrastructure, to help connect players beyond 'regional clusters,' via complementary linkages and along relational networks. As these economic currents shape human behavior across geographic boundaries, our relationship to place becomes even more important— policy and programmatic instruments now need to support hyper-local place initiatives as well as hyper-linked economic actors to best grow the economy. Additionally, with the lack of granular measures of innovation output to reflect the dynamically linked system, there is inefficiency and redundancy of economic development efforts by cities. The proposed strategies for accelerated innovation will recognize the connections between these specific places, their mutual dependency and complementarity, as well as the specific urban environments in order to boost growth and economic sustainability.

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¹ As observed by many, the engine of an innovation economy is knowledge-producing institutions (e.g. corporate, private and public R&D, universities), and their resulting business development activities from knowledge spillover, direct technology transfer, and supportive services.

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I am grateful for family, friends and colleagues who have supported me and who have been willing 'brainstormers' in my concepts about cities throughout the years. My parents, Maria Notar Haynes and my late father, George Edward Haynes, provided me with a foundational love of the City of Boston, my earliest physical environment and first visual memory (skyline from Storrow Drive, driving into Back Bay) that inspired my love of cities. They also encouraged my curiosity and ambition, but most importantly inspired my love of travel that has brought me to such great cities. New Haven friends are numerous, but I am thankful for great friends Jennifer Siegel, Elizabeth Steele, Rob & Gina Narracci, Dave Coon and Aicha Woods for being happily complicit in 'crazy idea,' and always willing to lend an ear. Additionally I am eternally grateful for the enduring support from Edward Dionne and Charlie, who have inspired me, and tethered me, during the most influential period of my life.

This thesis could not have been possible without the enthusiastic participation of the many people mentioned in this document, and most importantly some of the key readers of this document. I very much appreciated structural framing insight from Professor Fiona Murray of MIT, my advisor, and of course I benefitted from her expertise in catalyzing regional entrepreneurial eco-systems. In particular, early conversations with Professor Calestous Juma, Harvard Kennedy School, and Joost Bonsen, MIT Media Lab and Sloan Fellow Alumnus inspired me to continue with what was a very personally-challenging research project. Engaging and influential feedback from the Mayor of New Haven, John DeStefano, a valued mentor, was specifically useful during the writing of this document. Constant support from the MIT Sloan Fellows Program Office, especially Stephen Sacca, Marsha Warren, and Mary Marshall, helped me maintain enthusiasm for the project many times. For technical insight and a terrific second pair of eyes, I am thankful to Heather Dill of the Sloan Educational Services, and Paula Maule of Wordwise Editing--a tremendous help in finessing the writing in the final draft, and assuring clarity of the concepts.

It has been an extraordinary year, as a Sloan Fellow at MIT Sloan School of Management. This intense experience has changed the course of my life and provided me with the energy and inspiration for the remainder of my career. Most importantly, I would like to thank close MIT colleagues Laurie Zapalac, Priya Giri, Simon Colley, and especially, Pere Francino and Nora Sanchez Brion who helped me get through some of the most difficult moments of this process. To them I am forever grateful.

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BIOGRAPHICAL NOTE

Anne Gatling Haynes AIA (US) has held leadership roles in urban economic development, architecture, project management, and community development. As CEO of the Economic Development Corporation of New Haven (EDC), Anne led a public-private partnership between the City of New Haven and Yale University that was engaged in business development and long term economic and real estate planning for the City.

Previously, she served as the Design Director/Program Manager for the City of New York, Office of Mayor Michael Bloomberg, as a lead representative for the Deputy Mayor for Economic Development on municipal development projects in collaboration with City, State and Federal agencies. Her involvement in the World Trade Center (Performing Arts Center), Hunters Point South workforce housing development, Penn Station/Moynihan Station Redevelopment, and Javits Convention Center, provided her with an in-depth background of the economic and political forces that shape a city, and key development projects.

Prior to that appointment, she was a Senior Associate at Pelli Clarke Pelli Architects of New Haven where she led the design and construction of a variety of institutional and mixed-use buildings, as well as directed the feasibility planning for campus and urban district development projects.

She has been a catalyst for community economic development initiatives as a co-founder and Board of Director for CitySeed that operates a network of farmers markets in New Haven as well as directs food policy initiatives for New Haven and Connecticut. More recently, she was also instrumental in bringing 'The Grid' to life, the State of Connecticut's first innovation hub to New Haven by working with the State to craft the program, connect various innovation stakeholders, develop new programs to support business venture creation and innovation, secure funding through a competitive bidding process, and set up the launch of the project.

Anne received her Masters in Architecture at Yale University, and Bachelor of Science in Architecture from the University of Virginia. She was a Fulbright Scholar in Italy studying 'Infrastructure in the Creation and Reuse of Italian Cities,' and has taught Architecture and Urban Design at institutions such as Yale University, Columbia University, and University of Houston. She is currently a MBA candidate in the MIT Sloan Fellows Program in Innovation and Global Leadership, expecting to graduate in June 2013.

Most importantly, Anne is inspired by cities of all shapes and sizes, enjoys travel, cooking, and running (especially in new places!).

annegatling.com

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I. OBSERVATION | The Architecture of the Innovation Economy is in Transformation

At this moment of global economic transition, we must reevaluate and update economic development policy to further fuel recovery given that policies to date have not resulted in real progress. In fact, policy and programming at the federal, state and local levels have been relatively static for decades while the basic economic structure of this country (and the world) has shifted dramatically.

Many observers have noted that the engine of an innovation economy is based in knowledge-producing institutions, and the resultant business development activities from direct technology transfer and supportive small businesses involved in this transfer. However, these entities and activities are less the 'engine' as the people involved. Most critically, these institutions and corporations, especially those engaged in entrepreneurial ventures and those with risk capital involved, no longer operate in just one place. People, knowledge, and the money that supports their endeavors are connected to multiple cities, and constantly moving between them at ever increasing frequency. As described by many scholars, historically people, knowledge, and financing related to the innovation economy tend to cluster in regions, but these places are intra- and extra-linked by the movements of the entrepreneur. Rather than seeing these connections as filaments to be 'tugged' towards one place or another (creating municipal competition), which slows the growth of the company, economic development policy should take a big picture view that unimpeded flow would facilitate faster, more sustained growth overall. The economic geography of innovation—the way these actors come and work together—has been transforming, and redefining the specific boundaries of activity that stretch beyond traditional governing frameworks, thus highlighting the increasing role of 'place' in supporting innovation.

Cities have always been a hub of innovation activity, and the larger 'gateway' cities (e.g., Boston, New York, San Francisco, Houston) have been a natural melting pot of institutions, talent, and entrepreneurship. These cities have defined the country's economy for years, attracting waves of young people and immigrants who have fueled its growth. More importantly, this growth results from direct collaboration and knowledge transfer which, as economist Edward Glaeser trumpeted in his book *Triumph of the City*, is "the central truth behind civilization's success and the primary reason why cities exist.... cities magnify humanity's strengths and spur innovation with face-to-face interaction"² However, in the age of 'choice' and availability of inexpensive transportation and communication, we now have a new landscape of hyper-connected places based on workers' easy mobility and multi-locational existences, resulting in the transformation of the 'workplace.' Larger cities and regions that have established economies of scale to support a diverse range of innovation-oriented actors have become 'hubs' and examples of a mature innovation economy. These gateway cities could continue to build their economies by increasing the flow in and between secondary markets to which they are most connected.

² Glaeser, Edward, *Triumph of the City*, (New York, NY: The Penguin Press, 2011), 15

Large 'gateway' cities, oft-recognized urban hubs of innovation, face major inherent challenges, however. Most of these larger cities need a network of smaller cities to support their businesses and employees, providing a variety of choices and locations (for offices, manufacturing facilities and for workers to live and obtain education), affordability, and cultural diversity. The regional structure is effectively a 'supply chain' of smaller economies that are connected through people, business networks, and land use patterns. Most importantly, these larger regions—a network of cities-- provide in aggregate a 'critical' mass in traditional industrial terms, and also they need to support lifestyles at multiple scales---local, regional, and meta-regional contexts. For instance, they must provide quality schools, cultural activities, access to public resources, common and engaging public spaces, and environmental protection. Increasingly the ability to provide quality of life amenities have become more valuable to attracting and retaining talent as any other education or career opportunities, both for large and small cities alike. Both small and large cities are replete with significant resources that support the innovation economy.

In fact, many of the world's leading academic institutions, corporations, and contract research and development labs are located in 'secondary' urban markets but are as critical an engine to the economy as the primary cities, especially if considered in aggregate, and as a spoke in a system of other research hubs. The smaller urban markets that have the greatest potential for growth could leverage their scale and impact, if supported, to establish meaningful, productive networks to connect them — based on functional relationships — to each other and to the more mature hubs. According to Joel Kotkin, these secondary cities contribute about 70% of the U.S. GDP, and are the fastest growing (in terms of population and number of jobs) in the country; their growth rate is up to 15% greater than that of the largest cities.³ According to McKinsey, this is a global trend, where 'middleweight' cities are providing more robust growth than 'megacities.'⁴ These smaller hub cities could accelerate their productivity if better supported with innovative economic development policies that leverage the ever-increasing, multidirectional flow of talent, capital and knowledge to build an effective critical mass, and provide a greater boost to the overall economy.

These cities are the best environments to view the significant acceleration of a growth economy, despite the fact that they are less visible than the established entrepreneurial innovation hubs. The challenge that many of these urban environments face is their scale—they are generally too small to function as established industry-cluster models or are reliant on singular industries, they must compete regionally for scarce state and federal dollars, they create redundant governance structures, and they lack expertise or sustainable funding, which can lead to 'recreating the wheel' and wasted efforts and funding. However, that same intimate yet urban scale allows for quick engagement of the triple-helix strategy⁵, and these smaller cities enjoy a level of social networking, knowledge spillover and innovation ignition (and lower costs!), which is unparalleled. In recognizing the potential of these smaller cities to further fuel the economy, we then need to find additional means to support and propel their growth. Most critically, efforts to connect these cities have been hampered by competition at the local and

³ Joel Kotkin, *New Geography: Small Cities are Becoming a New Engine of Economic Growth*. May 8, 2012

⁴ McKinsey. "Urban World Mapping the Economic Power of Cities, McKinsey Global Institute Report ." McKinsey Insights & Publications. (McKinsey. 2012)

⁵ Henry Etzkowitz, coined this phrase, and it occurs in many publications.

regional levels, and at the super-regional level by common state political inequities and federal policy frameworks.

Rather than focusing on a city-to-city comparison, based on flat economic data developed to view larger economic trends, ineffective competition for resources, and rote replication of economic development programs (everyone wants a biotech hub!), the conversation about innovation should recognize and exploit the networks between cities, and options for complementarity, which ultimately boosts growth and creates economic sustainability. Networked cities, and a focus on the people that drive their economic potential, should underpin sustainable economic development strategies going forward. However, this emphasis should not revolve solely around the network alone, because people are social animals and innate creatures of the physical space and the localized context that supports their endeavors. We must understand not just the specific economic activities of innovation, but also the contextual framework of innovation to better accelerate innovation activity. Therefore we must consider the investments and infrastructure that parallel and support these environments so as to best grow the innovation economy.

Perhaps the most significant factor in rendering value and awareness to these recent economic shifts is their lack of visibility, and our inability to accurately communicate productivity in terms that the general public (and governments) can understand. The existing economic metrics, such as jobs, GDP, wealth growth, and industrial output, do not capture the velocity and complexity of the productivity that we witness on a daily level, but these metrics are most often quoted, and fail to capture subtle trends in the economy, oftentimes leading to an overall sense of anxiety. With current tools we are unable to visualize or personalize the flow of people, money and knowledge into and out of our cities in a way that we can see its benefit to the growth of the local and overall economy, and therefore participate more fully.

II. CHALLENGE & VALUE PROPOSITION | Fixing the Mismatch of Geographically-Specific Policy Frameworks to the Increasingly Borderless Economic Activity

Current governmental policy and development initiatives have failed to catalyze a period of real sustained economic growth as they are outdated, confined to a local political lens, subject to regional competition, or locked into a federal policy with too little financial strength to make a strong impact. As a vestige of political and tax-based representation, typical economic development policy (city, state, federal) is not aligned with how innovation economies operate, and therefore unable to leverage the increasing connectivity and velocity of business activity, in and between places.

In general, federal, state, and local policies have been generated incrementally, over time, resulting in an integrated vertical fiscal channel structure that cannot readily adapt to new trends from the private and institutional sectors. Governmental funding is, of course, a historical reflection of our democratic values, whereby the citizens of a jurisdiction have a right to see that its own local and state resources/funds are spent on programs, infrastructure and facilities that benefit their physical location. However, these jurisdictional lines may have less relevance on the daily lives of the people, and their interactions, especially activities in the innovation economy such as collaborative technological or scholarly research and development that tend to extend past a local geographic boundary.

If *economic development* is defined as an “act of organizing resources to initiate commercial activity,”⁶ then even local policy should align resources and initiatives to the trends within the economy that is increasingly driven by extended personal and corporate networks beyond specific geographies. The current policy framework creates friction in the flow of the economy, thus hindering growth. Thus, economic development policies (in the traditional mode) quickly reinforce competition between jurisdictional boundaries, which then create inefficiencies of governance, a ‘silo’ mentality, and lack true ‘learning’ that can be gleaned across and within networks. Cities thus need to reduce the friction by enabling easy interchanges between places to better support innovation and overall job growth. To do so, they must define and enhance the visibility of their unique signatures, or ‘competitive advantages,’ so that people/workers can choose places that suit their personal and professional interests.

Gateway cities have the benefit of learning from successive waves of innovation and economic growth, and have a scale of activity that makes it easier to support natural success without the need to intervene with catalysts such as incentives. However, flush with greater resources, these cities remain locked in ‘competition’ with each other and often expend inefficient effort to draw ‘big fish’ to their markets, which may help them, but not necessarily increase the overall size of the economic pie. Secondary markets, where many lead players of the innovation economy are located, need a unique set of strategies that should be different from primary markets, due to their smaller scale. More importantly, they need better mechanisms for linking the affiliated cities, despite political jurisdictional boundaries. It is not useful to ‘copy’ mature clusters of activity that have developed over many years and have a scale of activity that provides a different system dynamic than can occur in smaller cities.

Typical policy drivers, at best, aim to mimic successful, mature innovation-industry ‘clusters’ by trying to increase activity at research universities through investments, increasing the availability of venture capital, boosting local professional networking events, and by marketing their regional aspirations and recruiting ‘celebrity’ corporate brands. At worst, these policies tend to create local competition and ineffective use of resources, and they initiate games of ‘stealing’ companies across borders by incentivizing moves with ever increasing ‘goody bags’ (e.g., tax breaks). Most if not all of these strategies have proven to be unsustainable. Most critically, Michael Porter’s seminal work to identify clusters as regional economic development engines has been misinterpreted when integrated into local policies—these policies are industry centric, but not grounded in the local reality and they reward some companies, and ignore others, further inhibiting growth. Given recent economic development initiatives where taxpayer dollars have funded companies that subsequently have gone bankrupt (i.e. Solyndra, US Government, DOE financing debacle 2012) or companies have moved to other countries (and states) where the ‘goody bag’ is higher⁷, perhaps it is time to revisit the way that scarce resources are allocated.

Fundamentally, and most importantly, we are seeing transformative change in the business environment that requires a retooling of policy, programs, and investments at a systemic level.

⁶ Maryann P Feldman, “The Entrepreneurial Event Revisited: Firm Formation in a Regional Context.” In *Industrial and Corporate Change* 10, no. 4 (2001), 863.

⁷ Richard Florida, *The Atlantic Cities Jobs and Economy: The Uselessness of Economic Development Incentives 2012*; <http://www.theatlanticcities.com/jobs-and-economy/2012/12/uselessness-economic-development-incentives/4081/>

If economic development is to provide wealth creation for local, regional, national markets by supporting the business community, and accelerating the economy, then it must adapt in tandem (if not in advance) with the economic engines — the innovation organizations and the people within them.

Lead institutional and corporate anchors are not effectively engaged in the current economic development system — most operate independently either on purpose, or due to lack of awareness. Increasingly, corporations are multi-locational, and becoming more distributed via network architectures—from their core business models to the new generation of relationships between business units and external affiliated companies. Many innovation and innovation-supporting businesses have recognized the need to be in multiple markets—whether to access talent, be close to customers, and/or supply networks. Real growth comes from allowing people, knowledge, and capital to flow freely through an active infrastructure, and from aligning the needs of corporations and anchor institutions to the specific economic needs of cities, but within a framework that suits both.

Finally, in an effort to provide a more robust framework for economic development, we must reconsider how to gauge success in the economy. Measuring success via short time-horizon measures would create a faster feedback loop, which can grow consumer confidence, and therefore the economy. Most metrics for 'success,' used by economists, politicians, and the public, are long-term metrics, often lagging behind real-time activity: jobs, real estate values, productivity (GDP), and per capita income. Although these numbers are reported regularly, they often lag behind actual activity, and the more palpable personal experience of that activity (i.e. personal sense of a robust environment) that enhances the environment for knowledge transfer. Thus, we should focus more on building, nurturing, and 'counting' the 'inputs' to the system (productive contributions to activity), and less on the static outputs; we should also focus on the ability to measure/visualize the increasing productive connections and personal relationships that can help build a more effective platform on which the economy can thrive.

III. MISSION | Seeding Concepts for Specific Strategies to Implement Based on research and the professional experience of this author, this document provides preliminary economic development program proposals that build and support connectivity between places. These proposals are designed to be implemented from and within municipal governments or corporate and institutional entities that support economic development of cities. Additionally the work identifies potential long-term structural shifts in the economy that can be further explored academically and professionally.

- Thesis: Foundations (Section 4), Identification (Section 5), and Analysis (Section 6)
- Connective Development Methodology & Strategies (Section 7)
- Implementation Strategies & Conclusion (Section 8)

IV. FOUNDATIONS | Establishing an Academic Basis and Acknowledging the Existing Contextual Framework

Methodology

This project is intended to be broad—an interpretive sweep of the economic issues that affect

and propel cities. It is a foundational effort to catalyze additional research and inquiry. This investigation draws on a variety of scholarly and popular press documents and sources, most of which were selected based on the relevant research of a particular function of the innovation economy. The informal interviews recorded here exhibit a variety of knowledgeable and experienced agents within urban innovation ecosystems. Evidently, this line of inquiry is a 'snowball sampling,'⁸ a core concept that continually builds on itself without the benefit of a deadline. What is represented here is a set of indicators of this core concept and initial ideas for implementation, likely to be further developed by the author in future endeavors, as well as by others.

While this thesis is framed around direct innovation economic development experiences in New Haven, Connecticut, and New York City, and is a result of much investigation into a number of other American cities, it is clear that the issues facing these cities are not exclusive to the United States. There are direct parallels with the developed world, including Western Europe, and also the emerging markets. As the balance of economic power shifts to the East and South over the next 15–25 years⁹, it is imperative that we learn from what the United States and Western Europe has learned so that the growth in these emerging economies moves forward in an intelligent, thoughtful and sustainable fashion that is productive (connected!). With the challenges facing the global marketplace (from economic and environmental to geopolitical), it is increasingly critical to grow and maintain established networks between cities irrespective of national boundaries, and to support place-based development.

In the course of identifying and defining analysis frameworks, and then 'measuring' them, this author found a need to introduce/propose new metrics in order to capture some of the activity within the innovation economy well before it can be measured in traditional standard economic metrics (e.g., job growth, GDP). More specifically this thesis identifies a few organizing themes for overlooked yet critical data: the multi-locational networks of people and companies and their aggregate contribution to productivity, locational engagement quotients that show fertile ground for innovation (e.g., a best place for investment?), and quality-of-life aspects that further benefit people's intimate connection to place.

One issue has become clear in this investigation: we need far more scholarship focused on this topic. The author's intent is to highlight opportunities for future investigations and provocations to further stimulate the innovation economy.

Theoretical Framework | Scholarship Review

Intended as a systematic review of the dynamic forces behind urban economic growth, this project could easily touch on almost every theory of urbanization and innovation. The forces that shape urban economies, and the resulting effects, are intriguing, but the causal relationships are effectively elusive. No single solution or strategy can boost an economy, due to the complex system of interrelated factors that drive economic activity (i.e. labor, resources, policy, etc). Therefore, this section highlights foundational concepts that can be directly translated into pilot programs; its aim is not to be exhaustive.

Fundamentals of an Innovation Economy

⁸ Conversation with Fiona Murray, 4.17.13

⁹ McKinsey, "Urban World Mapping the Economic Power of Cities, McKinsey Global Institute Report .".

To understand the mechanics of accelerating economic growth in innovation economies, we must look at the foundational principles of what makes an economy innovative. Many scholars have pointed to the ingredients of environments and resources that form the loci of innovation such as research universities, industrial affiliations and social structures that connect them, as well as individual entrepreneurs. A survey of 1,000 business leaders by an independent consultant to GE found that the cultural contexts for innovation are driven by two particular values: embracing 'competition' and the societal recognition of its importance. Therefore, no innovation is possible without the appropriate conditions for its success.

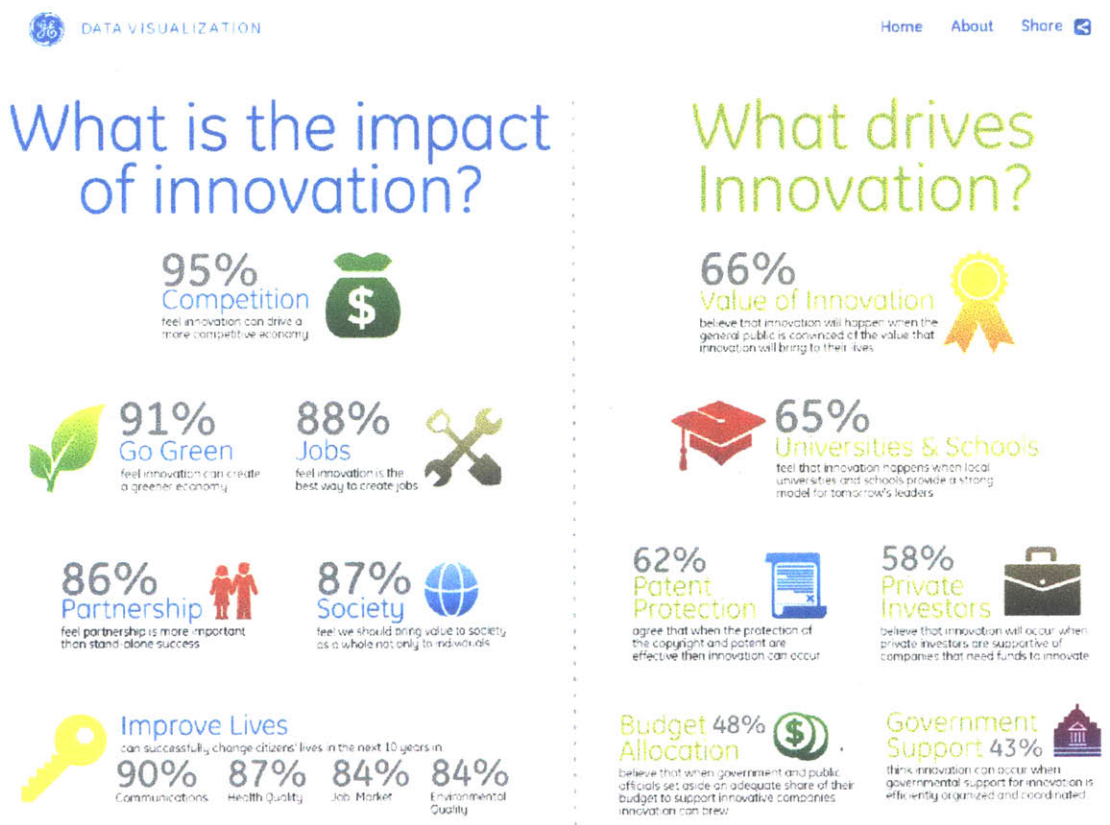


Figure 1: Understanding how the business community considers innovation based on a survey by General Electric (GE), Image by GE Data Visualization¹⁰

Michael Porter's landmark scholarship on industrial clustering tendency is currently a fundamental 'truth' to an innovation economy—groups of companies, resources and talent tend to want to be close to each other, building a critical scale of activity. Thus, in geographic clusters, they build an extensive economic system, each unit stimulating and reinforcing the other.¹¹ From this original scholarship, a generation of follow-up studies have been turned into policy frameworks at the federal, regional, and local levels, reinforcing this paradigm. Anna Saxenian's review of widely recognized, established innovation clusters in California's Silicon Valley and the Route 128 cluster outside of Boston clearly defines the cultural and productivity differences between a relational-network-based economy and a pure industrial cluster

¹⁰ <http://visualization.geblogs.com/visualization/innovation/>

¹¹ Michael E. Porter, "The Competitive Advantage of Nations." In *Harvard Business Review* (March 1990).

economy.¹² More recently, Fiona Murray, MIT Sloan Professor of Management of Technology, and Faculty Director for the MIT Martin Center for Entrepreneurship, identified 'Innovation-Driven Entrepreneurship' as a distinguishing type of innovation, pointing out a key set of high-growth potential actors in the formation and success of regional economic clusters. As Maryann Feldman points out in her 2001 essay *The Entrepreneurial Event*, "viewing entrepreneurs as agents of change is critical to understanding not only the entrepreneurship event but also the creation of a positive local environment."¹³ McKinsey Consulting has created an industry out of mapping and defining characteristics of clusters.

Mapping innovation clusters



Figure 2: This image shows the 'categorization' that McKinsey imposes on specific data about innovation clusters to be able to generate conclusions and strategic recommendations. Silicon Valley is the dominant circle. This mapping does not reference anything with respect to city size, productivity per capita, or trending activity¹⁴

Paul Krugman expands on these theories of industrial clusters with regard to economic geography and the physical-locational dimension of economic activities. He finds that underlying economic trends significantly impact geographic dispersion: "Historical accident can

¹² Anna Saxenian, "Inside Out: Regional Networks and Industrial Adaptation in Silicon Valley and Route 128." in *CityScape: A Journal of Policy Development and Research*. Vol 2, No2, (Washington DC, US Department of Housing and Urban Development, May 1996).

¹³ Feldman 2001, p.863

¹⁴ McKinsey Digital Image, 2009, as sourced from blog: Big Think. <http://bigthink.com/innovation/mckinsey-maps-the-worlds-innovation-clusters>

shape economic geography, and ... gradual changes in underlying parameters can produce discontinuous change in spatial structure."¹⁵ While this theory does not directly mention the specific trends in digital technology that eventually enabled our current economy, the theory does describe how geography of the innovation economy needs to be reconsidered given changes in technology. More specifically, Alain Rallet studies the distribution of knowledge transfer across networks and the redefinition of 'proximity' regarding knowledge transfer, a key piece of the innovation economy.¹⁶

However, there is limited scholarship on the direct links of innovation economies at the macro level, how networks of agents in the innovation economy are connected to each other, and how these linkages affect the overall productivity of a place, and the overall economy.

History of 'Big Policy' Leading to Innovation

The history of innovation in the United States, which has simultaneously led the international innovation economies since the Industrial Revolution, is marked by specific Congressional acts that were groundbreaking in their time, and transformational in aspiration. Our current policies are purely the result of these early economic development policies and reforms. The U.S. Congress's most recent acts to avert economic disaster and bolster the faltering economy during and following the 2008 financial crisis might be considered aimed at 'sustaining innovation,'¹⁷ as the acts prompted incremental steps that did not result in significant economic growth, although they help to contain the economic decline and protect against further economic erosion. The Obama administration has initiated fewer 'heroic' economic development initiatives, despite the historic recession, yet it has ushered in more foundational and institutional changes that may prove effective in the long run. A primary tool for fostering robust economic development has been research funding that has emerged from many federal agencies, and is broadly disbursed through research institutions, including universities, and public and private enterprises.

At the dawn of the American Industrial Revolution, the Morrill Act of 1862, and then 1890, married scholarship to applied research and development in particular fields by establishing Land Grant Colleges, which were institutional enablers of formal innovation in research and development. Differentiated from typically the liberal arts mission of existing universities (mostly private) these educational 'laboratories' were intended to provide workforce and innovative technological solutions in agriculture, science, engineering, military science, innovations that would support both the military and economic interests of the burgeoning country.¹⁸ The establishment of Land Grant Colleges, perhaps the first national 'place-based' economic development initiative as land was dedicated to colleges in every state of the union, was a fundamental acknowledgement of macro-economic goals as the colleges were tied to a specific geographic location.

¹⁵ Paul Krugman, "What's New About the New Economic Geography" in *Oxford Review of Economic Policy*, Vol 14, No 2; (1998), p.7

¹⁶ Alain Rallet and Andre Torre, "On Geography and Technology: Proximity Relations in Localized Innovations Networks," in *Clusters and Regional Specialisation* (Pion Publication, London 1998)

¹⁷ Clayton Christensen Lectures at MIT Sloan School of Management, 3-4-13

¹⁸ Note—the leading military tools of the day directly emanated out of agricultural technology, such as the Gatling Gun (inventor Richard Gatling is an ancestral cousin of author)

After the original patent acts in 1790 and 1836, which formalized our modern U.S. Patent Office and System, a series of reforms have attempted to promote technological development and investment for economic gain. The Bayh-Dole Act of 1980 further formalized the notion that technology from universities and government labs was worthy of validation through the patenting and licensing process, and that universities and government labs should share in the value with the government, thus leveraging knowledge into the private sector,¹⁹ and supporting localized economic development. Although the act recognized the need to increase commercialization, it has been noted that the Bayh-Dole Act may have overestimated the university and lab institutions' capacity for commercialization, and its resulting output as there have not been as much of a flood of economic growth from this source from all universities, just those with significant expertise.²⁰

The most recent patent law change, the America Invents Act 2011, fundamentally shifted from a 'first to invent' right to a 'first inventor to file' provision in order to align more closely with worldwide market practices and regulations. Certain application procedures of this act remain at odds with those of international patent applications. This recent change, though controversial, was nonetheless enacted. The 2011 Act is likely to very directly affect university and small company patent procedures, potentially creating a negative drag on the growth that the 'formal recognition of the global economy' of this act (and patenting as a means to competitive advantage) had intended to inspire. Additionally this may affect local business development when spinouts from universities slow. According to a Presidential White House memo released in October 2011, the government clearly recognizes the hurdles with technology transfer processes within government agencies, but the Executive Order requests that these agencies step up internal accountability, but is lacking in specifics. The National Institute of Standards and Technology (NIST) agency responded the following year with an update clarifying the activity and ongoing work needed to standardize the monitoring and reporting of technology transfer activities across government agencies. This document appears to be simply the beginning of annual reporting, and too early to tell if it has resulted in any real progress.

Finally, at the macro-policy level, Glaeser has written extensively on the role of 'free flow' in the economy with respect to current (and future) policies that might help or hinder economic growth. He posits that an open city and closed borders will reduce economic growth because "when tariffs close borders, urban growth slows."²¹ Whether considering patents, immigration, trade, or financial regulations, this concept certainly affects the people, knowledge, capital, and corporations that make up the innovation economy. Inevitably, given the increasingly global nature of personal-professional relationships and the means to connect in the act of innovation, the level of national policies towards borders (technology transfer, and immigration in particular) will critically affect the economy, and a nation's competitive advantage.

Sequence of Innovation

¹⁹ Prior to Bayh Dole Act, 28000 patents were on file with the U.S. Patent Office, but only 5% had been commercialized. The act was a direct response to the 1970's recessionary environment.
http://en.wikipedia.org/wiki/Bayh-Dole_Act

²⁰ Rochelle Dreyfuss, Double or Nothing: Technology Transfer Under the Bayh-Dole Act, 2011

²¹ Glaeser, Triumph of the City p.252

Innovation unfolds in a specific sequence—covering a spectrum of activity beginning with initial pure research leading to an innovation idea, its development and then to business creation. This process requires legions of people, various modes of interaction, and most importantly, investments along the way. Maryann P. Feldman and her colleagues have carried out a broad set of studies at different points of the innovation path. At the start is the emergence of an idea that could be commercialized, or the 'Entrepreneurship Event,'²² that, depending on the context, can lead to a unique path through a variety of iterative processes, considered the innovation path. The steps of the university technology transfer process vary greatly²³, but it is well documented in a number of industries, specifically biotechnology, that links to university technology research and industry participation mean higher licensing activities (licensing University technology to companies) for commercialization.²⁴ Most specifically, in this path, the most fundamental lubricant of the innovation economy is the research activity and potential knowledge spillover. As Audretsch and Feldman point out, "innovation dollars at universities benefit innovation in small firms more than industry R&D dollars which inputs to large firms innovative capacity."²⁵

The incentives for innovation are based on creating value, novel discoveries, and unique inventions. Those who gain from knowledge spillover are the smaller scale firms, individual entrepreneurs, and students, who can more quickly propel growth/value faster than can a larger organizational structure with more levels of bureaucracy, less explicit incentive to do something unique, and overhead. As many researchers have noted, knowledge spillover happens in places with a concentration and diversity of knowledge, where frequent and meaningful connections between knowledge agents can occur, and in supportive physical and intellectually stimulating environments conducive to personal and professional interactions.

Also critical in the sequence of innovation is the propensity of the innovation economy to feed back on itself in successive generations of business creation, spurred on by endogenous economic events, followed by the emergence of mature innovation economies. As an example, Feldman points out the evolution of the technological innovation in the Washington, D.C. area from government downsizing in the last 40 years. This downsize event created ample opportunities for service companies to be contracted to the government, further leading to internal technological development that spurred first- and second-generation innovative and high growth companies.²⁶ Additionally, it has been well documented that following the financial crash of 2008, the financial services industry in New York City created a whole new flock of 'accidental' entrepreneurs, at the time when the emerging visibility of 'startups' and other local business creation opportunities had great armchair appeal.

²² Feldman, Industrial and Corporate Change.

²³ Daryl West, "Brookings Institution Research: Improving University Technology Transfer & Commercialization." (Brookings Institution, 2012).

²⁴ Maryann Feldman and Maryellen Kelley, "The Ex-Ante Assessment of Knowledge Spillovers: Government R&D Policy, Economic Incentives and Private Firm Behavior" In Research Policy 35 (Science Direct, 2006)

²⁵ David B Audretsch and Maryann Feldman, "Knowledge Spillovers and the Geography of Innovation" Indiana University and the Center for Economic Policy Research, University of Toronto. Paper presented Paris, December 2002, 4.

²⁶ Feldman and Kelley, Research Policy.

In the other realm of innovation, known as stealth innovation where a new or small player can emerge as a leader in an existing industry in the form of a 'first mover' (i.e., inventing a new product or service), or an entity that enters at the lower end of an existing market, and takes market share from larger companies who have innovated 'up' into specialized products, by innovating on a less profitable product and increasing the market size in general. Clayton Christensen has written about the role of disruption in an industry by new actors who identify and enter at a low end of the market, and in fact broadening that market to consumers not previously included. Additionally, the independent emergence of companies can find ways to reach past existing regulations with new unregulated methods in order to create new markets and help shape the potential for innovation to occur anywhere.²⁷ In both cases, these types of innovation broaden the scale of the market and/or generally extend the reach of the business enterprise beyond existing market boundaries, and therefore the industry's economic geography.

Agents and the Culture of Innovation

In the end, the spectrum of innovation as seen through economic or institutional lenses is not the entire story. How agents activate and shape the innovation economy is just as critical, especially as it relates to the hypothesis of this project—the people themselves, and their productivity, are the 'atoms' and therefore units of an industrial economy.

Firstly, the patent system and the formal process of attaining intellectual property rights, in some industries, has a direct effect on knowledge transfer, and are considered 'agents' of the economy. A backdraft on innovation could be generated either in the lag time required for processing of patents or the slowing of citations that might also precede or follow patenting due to the requirements of the process.²⁸ In fact, additional effects might result from the new laws that shift the onus on filing over publishing. More recently, other mechanisms of knowledge transfer have emerged in the innovation system—i.e. not necessarily actors within a defined organizational structure. Given the explosion of new digital 'markets' for knowledge transfer, such as those described by MIT Sloan School of Management Professor Thomas Malone we are at the beginning of an era where we will see the emergence of new 'agents' who are less geographically tied to the place of industry and production.²⁹ This emergence will be further described in a later section on Corporate Research and Development.

The key factor to knowledge transfer and spillover is the face-to-face exchange well documented by academic studies and the popular news media. Given the more mobile nature of the economy as described earlier, knowledge transfer process is being transformed-- locational proximity in the process has become more complex. Different points along an innovation process need physically proximate partners to perform certain tasks/and activities, such as idea iteration, and/or conflict resolution. However, for most other points along the path

²⁷ Christensen Lectures at MIT Sloan School of Management, March 2013

²⁸ Fiona Murray, and Scott Stern "Do Formal Intellectual Property Rights Hinder the Free Flow of Scientific Knowledge? An Empirical Test of the Anti-Commons Approach " in *Journal of Economic Behavior and Organization*.(National Bureau of Economic Research, 2006)

²⁹ Thomas W Malone, *The Future of Work: How the New Order of Business Will Shape Your Organization, Your Management Style, and Your Life*. (Boston: Harvard Business School Press, 2004).

28: Alain Rallet and Andre Torre, "Temporary Geographical Proximity for Business and Work Coordination :When, How, and Where?" In *Spatial Aspects Concerning Economic Structures*. Volume 2 (2009)

(further into development/commercialization requiring multiple parallel processes) innovation actors can maintain a functional proximity through other technological means, revisiting the locational proximity at critical points for face-to-face interactions.³⁰ Knowledge spillovers do not recognize boundaries: "Krugman et al. (1991) did not question the existence or importance of such knowledge spillovers. In fact, they argue that such knowledge externalities are so important and forceful that there is no compelling reason for a geographic boundary to limit the spatial extent of the spillover."³¹

Most importantly, the primary agent is the individual actor. Brad Feld's Boulder Thesis (based on the Boulder, Colorado, startup cluster) identifies the entrepreneur as the key foundational agent and cornerstone in any innovation economy.³² Similarly, Maryann Feldman has noted that "individual entrepreneurs [are] in the best position to move the technology, the industry, and the region forward. Entrepreneurs adapt, and when they are successful, they build the type of resources that support."³³ The role of the pioneer spirit (e.g. an innovator, a new industry, new place, new direction) is critical to the economy, and has been the cornerstone of the U.S. economy for many generations. Most critically, however, the cornerstone of the economy is the talent base, and ability to provide ample opportunities for knowledge spillover. As noted by Richard Florida, "highly skilled people are also highly mobile—'churn' of the knowledge economy."³⁴, therefore any review of economic development strategy must follow the key components of that system.

Networks

The role of networks, personal and professional, have underpinned scholarship on innovation and business creation for many years—from alumni networks to industry affiliation networks. Given the new online tools that have facilitated networking over the last few years (e.g., professional and social networking sites such as LinkedIn and Facebook), these relationships take on an even more visible role. The network along which innovation occurs, although fluid and dynamic, is not just the ephemeral filaments of human interaction, but in fact the places that these human-current carriers are based—both permanently and temporally.

Networks can more easily be observed at local levels. Per Richard Locke's scholarship, the study of Italian regional clusters, developed over generations within an industry supply and support network, rely on trust as a fundamental factor in strong network ties.³⁵ Additionally, Anna Lee Saxenian has written extensively on the infrastructure of social/industry ties that shape networks, as well as the social 'mindset' of the place as a factor in strengthening networks. Saxenian describes how communication between individuals and the culture of knowledge sharing facilitate spillover: "The region's dense social networks and open labor markets encourage entrepreneurship and experimentation....The functional boundaries within firms are

³¹ Autretsch and Feldman, "Knowledge Spillovers" Paper, 6

³² Feld, REAL Class 10.13.12, and Brad Feld, *Startup Communities, Building an Entrepreneurial Ecosystem in Your City*. (New York: Wiley, 2012).

³³ Maryann P. Feldman, *Industrial and Corporate Change*, 886.

³⁴ Florida, Richard, "The Role of the University: Leveraging Talent not Technology" in *Issues in Science and Technology* (National Academy of Sciences 1999).

³⁵ Richard M Locke, Massachusetts Institute of Technology, "Building Trust," Essay from 15.S05 REAL course, 2012.

porous in the network-based system."³⁶ Conway and Steward point out the variety of networks and how different aspects of the innovation process requires different types of networks, and that informal personal networks support and sometimes merge with more formal professional networks. Many of these networks expand past boundaries in interactions.³⁷ Within the technology transfer process, it is common for 'spinoffs' of technology firms to have direct relationships with the personal network as a main conduit the commercialization activity. Looking at a specific sample set from University of Minnesota over a 10-year period, researchers found that the majority of the technologies were transferred via personal networks, some with ongoing relationships between companies and researchers, some via 'acquaintances' met at conferences.³⁸

It is clear even from the popular press that although entrepreneurship action might occur at the local level, entrepreneurs are mobile, and networks expand naturally through personal relationships of entrepreneurs and mentor networks. "Increasingly the components of these networks are situated across a wide array of locations. This suggests that the knowledge flows that feed innovation are often both local and global ... and a growing proportion of the knowledge base is not exclusively local" (Cooke, 2005).³⁹ The geography of networks \ may have a greater impact on the quality of the innovation, especially in science fields as "local networks are common but ... they may not be as large or as important as distant, even global ones."⁴⁰ Additionally, venture capital fuels the system, and plays a key role in creating a network between entrepreneurs.

As the global trade industry has developed, the global commodity chain has been described as "sets of inter organizational networks clustered around one commodity or product, linking households, enterprises, and states to one another. These networks are situation-specific, socially constructed, and locally integrated, underscoring the 'social embeddedness' of economic organization."⁴¹ The knowledge value chain is mentioned often in the literature as a 'global trade industry' in the expansion and production of scientific discovery. Furthermore, as Feldman and Kelly note, "successful clusters are those that are effective at building and manning a variety of channels for accessing relevant knowledge from around the globe."⁴²

Strong and wide networks alone are insufficient for realizing innovation, but they provide serendipitous meetings of minds and are catalysts of innovation. The value in the knowledge transfer chain is at the networks' input-output structures (the nodes), which are "centrally

³⁶ Saxenian, *Cityscape: A Journal of Policy Development and Research*, 45..

³⁷ Steve Conway and Fred Steward "Mapping Innovation Networks" in *International Journal of Innovation Management* (1998)

³⁸ Brian Harmon, et. al, "Mapping the University Technology Transfer Process, University of Minnesota" in *Journal of Business Venturing*, (1997).

³⁹ Maryann Feldman, Meric Gertler, and David Wolfe, "University Technology Transfer and National Systems of Innovation: Intro to Special Issue on Industry & Innovation" in *Industry and Innovation* (2006), 365.

⁴⁰ Phil Cooke, "Global Bioregions: Knowledge Domains, Capabilities and Innovation System Networks" in *Industry and Innovation* (London: Routledge 2006, 456.

⁴¹ Jeffrey Henderson, et. al "Global Production Networks and the Analysis of Economic Development" in *Review of International Political Economy*, (London: Routledge 2002), 440 : Quoting G. Gereffi and M. Korzeniewicz (eds) (1994) *Commodity Chains and Global Capitalism*. Westport: Praeger..

⁴² Feldman, Gertler, and Wolfe, *Industry and Innovation*, 365

important ... sites where value is generated."⁴³ These connections provide great benefits that lead to entrepreneurial success, and it is knowledge sharing that helps create value (in absence, value is lost).⁴⁴ Finally, more of these network nodes, where all the action centers, are dispersed than centrally located and these innovation nodes are linked by industry-specific networks, which as Philip Cooke notes is "[a] new global economic arrangement in which 'knowledge capabilities' ... rooted in specific 'knowledge domains' are producing a new global economic geography."⁴⁵

It has been recognized broadly that economic development activities, within both private and public governance structures are fundamentally based in multi-network management and that "networks are the norm."⁴⁶ *No economic development activity can occur without a network of related actors/entities involved in an initiative.* However, in all cases, scant scholarship has focused on measuring the specific impact (payoff) of these networks within the innovation economy, although much documentation focuses on the existence and mapping of such networks. Some scholarship points out the likelihood that such networks lead to increased commercialization and entrepreneurship. As Audretsch and Feldman point out,

...a research agenda needs to be mapped out identifying the role that investments in spillover conduits can make in generating economic growth. It may be that a mapping of the process by which new knowledge is created, externalized and commercialized, hold the key to providing the microeconomic linkages to endogenous macroeconomic growth.⁴⁷

History of Connecting Cities

Historically, the American mindset considers mobility and independence a natural agent of opportunity. Mobility and independence is increasing worldwide. In the 1950s, the significant rise of commercial aviation and the expansion of the U.S. federal highway system further expanded the American horizon for traveling and moving to new places, in a search for greater opportunities. European and other developed countries experienced the rise of car ownership, high speed rail, and additional highways a bit later than did the United States. Additionally, young people began moving far from their extended families for university studies and jobs.⁴⁸ More recently the rise of low-cost one-way fares, with no advance purchase, and long-distance buses and trains (now Wi-Fi-enabled), have further endowed the culture with a sense that distance is manageable, and opportunity is borderless.

In fact, the rise of super- and mega-commuters is growing. Many people now regularly commute to work over 100 miles away, using multiple modes of travel, including air. Metro areas report that from 3% (New York) to 13% (Texas) of their workforce are super- and mega-

⁴³ Henderson, Review of International Political Economy, 446

⁴⁴ Feldman and Kelley, Research Policy.

⁴⁵ Cooke, Industry and Innovation, 442.

⁴⁶ Robert Agranoff and Michael McGuire, "Multi-network Management: Collaboration and the Hollow State in Local Economic Policy" in Journal of Public Administration Research and Theory: J Part, (Jan 1998), 88.

⁴⁷ Audretsch and Feldman, Paris Cities and Geography Paper, 28

⁴⁸ These opportunities also set foundational networks in place that are further exploited in professional realms further past geographic boundaries.

commuters. According to Mitchell Moss, “an estimated 1.15 million workers from 10 large metro areas are super-long-distance commuters, and their numbers are growing; in Houston their numbers have doubled from 2002–09.”⁴⁹ This trend is fueled both by people wanting to take the ‘right job’ in a bad economy, but not wanting to uproot themselves and their families for personal or financial reasons.

When discussing the trend of routine trans- and cross-continental travel, the ‘Sister Cities’ program stands out as one of the first international programs aimed to connect individuals across continents. The program proliferated post WWII globally, but originated at the end of the Industrial Revolution when many cities experienced the social changes brought about by throngs of immigrants escaping their war-torn homelands. Formally introduced by President Eisenhower in 1956, the Sister Cities International’s mission is to “promote peace through mutual respect, understanding, and cooperation — one individual, one community at a time.”⁵⁰ These programs range in effectiveness and activities, depending on the core institutions that started the individual programs. Over time cross-border and cross-cultural relationships have flourished based on cultural exchanges. On occasion these ‘relationships’ are set up to formalize specific business/commerce exchanges, such as Massachusetts’ Sister City program with Basel, Switzerland, thanks to both cities’ direct links between their biotechnology clusters. The official Sister City website acknowledges the organization’s goals of building economic partnerships via personal and professional networks developed initially through cultural exchanges; these networks can further evolved into conduits to leverage additional commercial and political activity. However, this model is point to point, and not necessarily a cross-point structure.



Figure 3: Image is the Location of all the Sister City locations and partnerships—note that they are all point-to-point and not networked relationships.⁵¹

⁴⁹ Jeff Green, “Super Commuters Take the Morning Plane.” Bloomberg Businessweek, February 23, 2012.

⁵⁰ <http://www.sister-cities.org/mission-and-history>

⁵¹ <http://www.sitercities.org>

Additional types of network organizations connect cities. There are industry- or topic-affiliated national networks like the National League of Cities, and the U.S. Conference of Mayors, and the National Urban League. More specific workshop type of 'peer to peer' structures such as the Mayors' Institute for City Design, funded by the National Endowment for the Arts and the American Architectural Foundation, and 'CEO for Cities' that sponsors national conferences the bring regional leaders together for topic-specific networking and collaboration. Mayor Michael Bloomberg of New York City has been an avid champion of coordinating urban policies across cities with his Mayor's Challenge, and Mayor's Against Illegal Guns programs. Although not specifically a 'city' network, cities such as those inhabited by the Ivy League schools and other similar anchor institutions create natural frameworks for the discussion of localized economic development.

Another illustration of connectivity is the economic connectivity between a hub city and its relational support cities as well as the 'twin cities' model where the economic underpinning of two cities located on close proximity (e.g., St. Paul and Minneapolis) is inextricably interdependent; they often share regional planning and/or transportation systems, despite having separate funding structures.

A good example of the historically supportive role that smaller cities play in regional economies is illustrated in the Boston region, where small cities and towns have formed a critical 'network' since the Industrial Revolution. If we look at the successive waves of economic development that produced the mini-economies throughout New England, and the transportation infrastructure that links them, we can see a pattern of many necklaces. Drawing a ring around the 'Hub' city one sees the closer-in economies that ring the city along Route 495, including Lowell/Lawrence, Worcester, Providence, RI, and Fall River/New Bedford. These cities historically have had an independent industrial foci (e.g., textiles, manufacturing, fishing), and have served as important supportive immigrant hubs to the overall New England economy.

Finally, in meeting the challenges of global sustainability challenges, world challenges that clearly do not have a singular geographic origin, it has been easier for cities to 'connect' and learn from each other. Accordingly, cities have found opportunities to become leaders in addressing challenges that the larger institutions of national politics are unable to commit to. As stated by Elinor Ostrom, Nobel Prize–Economics winner for her work in network-based governance,

Worldwide, we are seeing a heterogeneous collection of cities interacting in a way that could have far-reaching influence on how Earth's entire life support system evolves. These cities are learning from one another, building on good ideas, and jettisoning poorer ones. ... [I]n the coming decades, we may see a global system of interconnected, sustainable cities emerging. If successful, everyone will want to join the club.⁵²

Defining Networked Cities and Meaningful Connections Between Cities

This author defines the 'networked city,' eponymous of this document, based on observation and by drawing on numerous documented trends on contemporary cities. A networked city is an economically relevant city—one that is connected physically, technologically, but more importantly is producing knowledge, and conducive to knowledge flow between itself and other places. Often a city is considered 'connected' if it has ample access to broadband and

⁵² Elinor Ostrom, "Green from the Grassroots" in Project Syndicate, blog (June 12, 2012)..

high-speed bandwidth, reflected in initiatives like Google–Kansas City, and the Intel Collaborative Research Institute for Sustainable Connected Cities. Additionally, the term ‘connected’ refers to transportation infrastructure that physically connects cities, such as major airports, commuter lines and high-speed rails. The term the ‘networked city’ has also been used, to a lesser degree, to refer to the talent that produces the technology to connect cities and people within them socially, and culturally. However, until now, the term has not specifically referred to the consideration of ‘agglomerating’ scale across cities, and across their political jurisdictions, which this document attempts to suggest might be an appropriate way to recognize the current innovation economy.

In this project, the term ‘networked city’ is applied to the contemporary city that recognizes that it is hyper-linked economically to other places. These cities both have *internal supportive tissue* (established social/cultural/institutional networks at an accessible scale) that helps connect people and provide opportunities locally, and also ‘externalizing’ forces such as global institutions and/or companies that connect to other regions along industry lines, and increasingly, personal/professional lines. These cities are learning that they can gain exposure to new markets, and beneficial ‘learning,’ via their myriad networks, effectively operating like a modern multi-national corporation. The networked city is also increasingly the ‘gateway’ into the larger economy. According to a 2011 McKinsey Global Institute Report on Urban trends, ‘Mapping the Economic Power of Cities, middleweight cities as opposed to nations have great potential for the world economy, “a strategy based on clusters of cities is an attractive option for many companies, particularly in large countries... that have significant regional differences in their market characteristics ...Country level strategies no longer have sufficient focus for many companies looking for growth.”⁵³

The best-networked city is one with a manageable scale, and a culture of accessibility such that the city is easily navigable along social and commerce networks by newcomer firms and talented experts and entrepreneurs. The culture of accessibility is best seen as a community of agents and influencers who contribute to a robust business environment, a community that provides a frictionless in road and out road to new actors from broader economies. This fluid wave of people, including the diaspora of institutions and large corporations located in that place, create cities that have a broad network of loyal ‘followers’ and regular ‘visitors,’ who further network the city to additional places.

The diversity spectrum of industry in a place, given the scale of the city, as opposed to a mono-industrial profile, are critical to the long-term sustainability of the city, as we can see from such urban tragedies such as Detroit, and more keenly, Flint, Michigan. Additionally, it is the relative number of smaller firms per scale of the city that gives the city more vibrancy and potential for additional innovation.⁵⁴ In fact, some of the secondary market cities, the smaller ones, have a greater capacity to sustain the more-firms-per-worker, leading to economic success. As seen in the image below, cities like Sarasota, Sacramento, Phoenix, Baltimore, Seattle, Portland, Richmond, and Memphis show a higher rate job growth than larger cities like New York and Boston due to the fact that smaller firms tend to add higher numbers of jobs than larger firms. Additionally, urban clusters with a high concentration of one industry may

⁵³ Dobbs et. al, Urban World: Mapping the Economic Power of Cities, 6-7

⁵⁴ Edward Glaeser William Kerr, “The Secret to Job Growth, Think Small,” in Harvard Business Review (July 2010).

have limited knowledge spillover capacity—a diversity of industries may promote more inter-industry knowledge spillover.⁵⁵

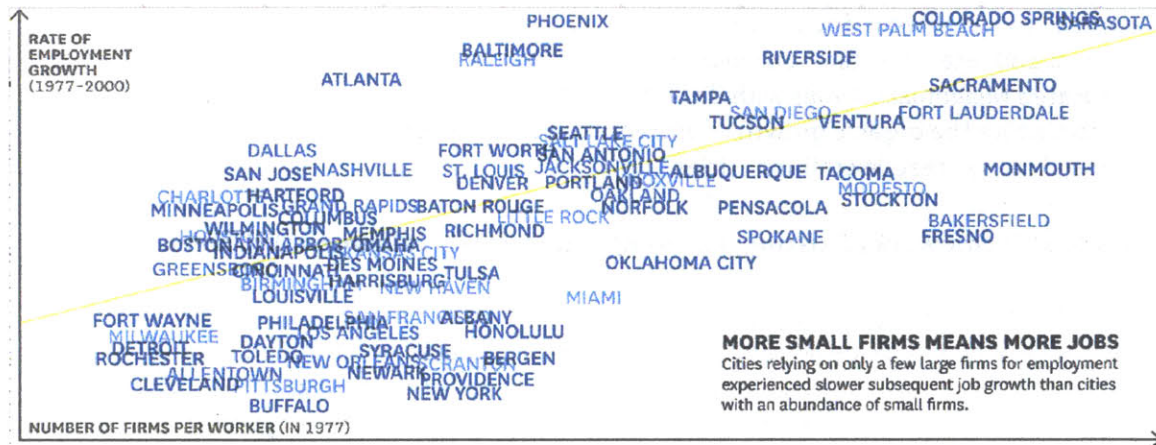


Figure 4: Small Firms per Worker per City Image which shows the potential for job growth in areas with a higher concentration of such firms, lending insight to where there are productive economies.⁵⁶

Additional factors that seem to benefit the growth of the innovation economy in smaller cities is that smaller regions (based on the Metropolitan Statistical Area) are more likely to collaborate on scientific papers than larger cities as measured by multiple authors on published papers.⁵⁷ Additionally due to extensive personal and professional networks, many individuals who have had broader life experiences geographically, culturally and socially, for example, via university education and jobs that have taken them to distant locations, will be more naturally able to initiate and execute along these network lines. Technological tools do not replace tacit knowledge exchange, but that offer non-co-located networks, provide additional material and opportunity for contact.⁵⁸

The most visible networked cities are larger cities surrounded by a series of linked smaller cities (e.g., New York City with Westchester NY, New Rochelle NY, Newark, and Stamford CT or Boston with Providence RI, Cambridge MA, and Portland ME) "Very large cities attract the most talent and inward investment, and they are often at the center of a cluster of smaller cities, which creates network effects that spur economic growth and productivity."⁵⁹ This situation is becoming even more apparent as the larger cities are becoming more expensive to live in, and innovation economy agents such as entrepreneurs and startups, as well as the creative class, are starting to discover these secondary markets as great opportunities for quick growth.

⁵⁵ Audretsch and Feldmen, Paris Cities and Geography Paper

⁵⁶ <http://hbr.org/2010/07/the-secret-to-job-growth-think-small/ar/1>

⁵⁷ Olivier H Beauchesne and Eric Archambault, "Scale-Free Geographical Mapping of Scientific Collaboration of MSA's" in Science Metrix presentation to 45th Annual Meeting, Cleveland Conference, 3 November 2011

⁵⁸ Alain Rallet and Andre Torre, "Temporary Geographical proximity for business and work coordination :when, how, and where? " in Spatial Aspects Concerning Economic Structures. Volume 2 (2009)

⁵⁹ Dobbs et. al, Urban World: Mapping the Economic Power of Cities, 11

Most critically, a networked city offers the facilities and accessibility to new arrivals, and conversely allows people to remain connected to a place. Social and cultural amenities (e.g., theatre, music, arts, sports, education) provide the locus of interaction in and out of a networked city. As often mentioned by Richard Florida—supportive environments are those that attract and retain key talent including the ‘Creative Class’ and now the new generation of well educated Millennials. Cities with desirable (safe, clean, upscale) urban neighborhoods are shown to nurture the organic growth of entrepreneurship in everything from technology to service, and many creative craft industries.

Contextual Framework | Existing Status of Economic Development Infrastructure

Local and Federal Support Structures

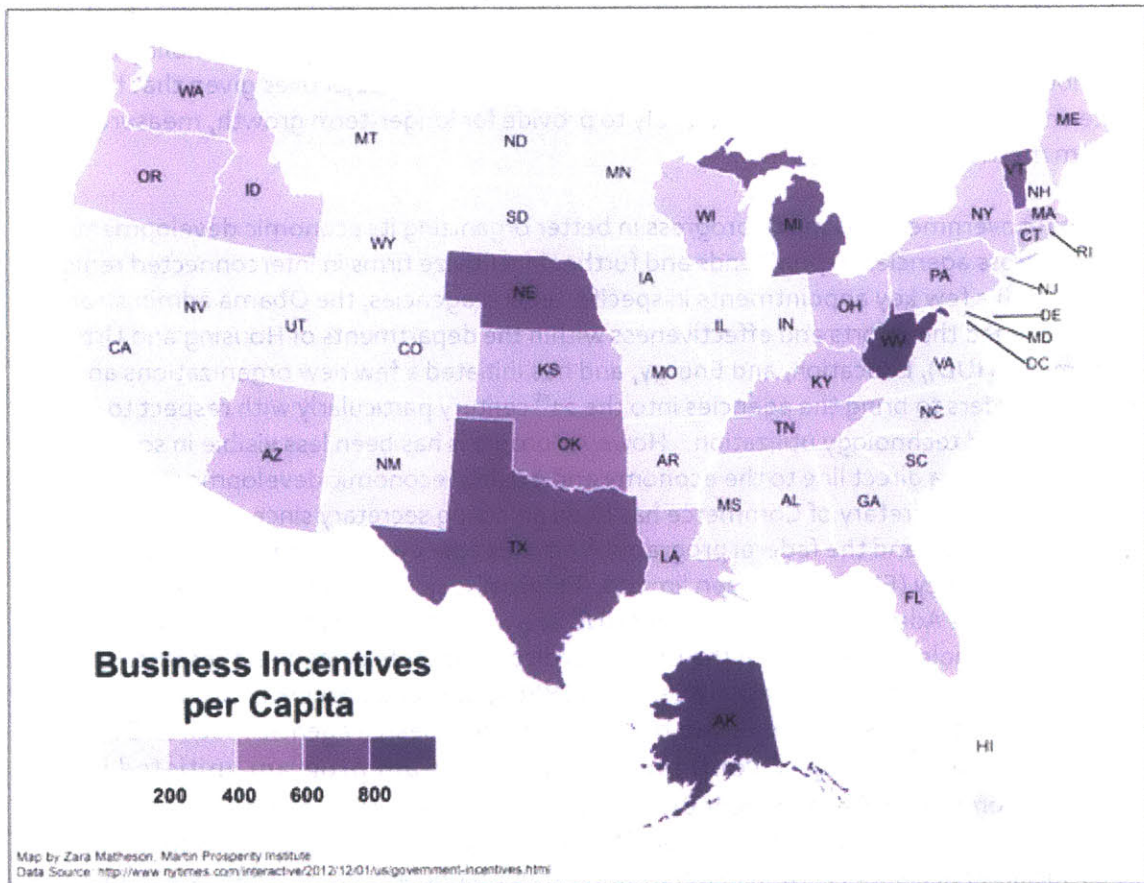
The structure of economic development is a vertically integrated, multi-tiered fiscal mechanism aimed to provide wealth creation based on the ‘investments’ of the tax base. The money flowing from a resident or a business goes to a town/city, state and federal government provide support to the citizens such as educational, social, and cultural programs/initiatives and jobs that ideally help use those taxes to grow the economy. As public funding for economic development efforts has dwindled, as city budgets shift towards supporting long-term obligations (health care and pension costs), many cities have had to resort to either semi-externalized efforts of development through utilizing existing institutions, or by forming local or regional Economic Development Agencies.

Many times these initiatives bring together public and private agents (leaning heavily on the local private sector) in quasi-public agencies. However, most local efforts need to be funded by someone or some entity, and most ‘seed funding’ runs out, especially as local conditions change (local companies and banks are sold to larger national entities, leadership changes in the private and public sector, etc.). Although there are increasing efforts at the local level to support business development, as it becomes more critical for local governments to retain jobs, local agencies have tended to replicate established models that have shown ‘success’ in the past without regard to whether or not it makes sense to ‘copy’ the model in the current economic climate, leading to much inefficiency. These efforts tend to fail, especially where these local agencies have a small geographic scope than the model initiative, and/or are led by individuals who lack expertise (but have large visions) to administer programs; they often result in redundant efforts, and tend to lack a scale of activity or success and momentum that can sustainably fund over the long term.

A primary tool of economic development historically employed at the local level has been the ‘incentive,’ which could be broadly defined as a financial reward offered to a company in exchange for job growth (either relocation or physical expansion), or a tax break that would reduce the company’s cost structure to move to the city for a fixed period of time. Often these incentives also aim for ‘retention’ — keeping a company from moving from a particular place, and remaining in the city, creating jobs and wealth. Incentives intended to provide a ‘finance’ gap to make it more feasible for corporations who may not consider relocating to the city for other reasons, or due to excessive costs borne by the business in that area (e.g., high energy prices in the Northeast). However, in recent years, this incentive and retention strategy has become a highly coveted ‘auction’ item that has pitted many states and cities against each other in competition for the best and the most promising companies, from small startups to multinational corporations. The scale of investments that cities make in attracting and

retaining companies does not necessarily reflect the deep coffers of the city or state, but rather the government's priority to 'play the game' and hopefully develop jobs as fast as possible.

A recent Atlantic magazine article reported on a powerful investigative series by the New York Times that revealed the folly of "economic development" investment programs state-by-state due to their lack of real success. The sustainability of economic development programs that reward money for jobs is questioned in light of the municipal fiscal crises. The article pointed out the lack of correlation between taxpayer money invested in companies and the overall economic metrics of jobs and productivity. The only positive outcome was that it eased the poverty rate, slightly, marginally. In fact, the article identified an additional study that showed that most companies that received incentives either lost jobs over time, or overestimated their projected job creation.⁶⁰ In fact, in practice, companies have been shown to be ill-equipped to project jobs numbers and often request incentives and forecast jobs based on the government's formulaic 'hurdle' for financing.⁶¹



⁶⁰ Richard Florida, "The Uselessness of Economic Development Incentives" in Atlantic Cities, blog, 12/2012. <http://www.theatlanticcities.com/jobs-and-economy/2012/12/uselessness-economic-development-incentives/4081/>

⁶¹ For example a company needing 100,000 would say that their projection is 10 jobs if the state's formula was \$10,000 per job (after often asking for more, for fewer jobs). This is from personal experience as CEO of the EDC, with companies in New Haven Connecticut

Map shows the incentives per capita expended since 2007, Image by Zara Matheson of the Martin Prosperity Institute based on data from New York Times, and as Reported by Richard Florida in his essay "The Uselessness of Economic Development Incentives."⁶²

At the next tier of local [community development programs?], a relatively unique state program, modeled after the MassVentures program by the state of Massachusetts in the 1970s, is Connecticut Innovations, an early-stage seed fund for technology-based ventures. Capitalized originally by the state of Connecticut, it has become a key driver and lead funding incentivizer for companies to locate at least a piece of their company to the state. In an effort to get even more granular in its efforts to boost innovation, the Connecticut 'hub' concept (mimicking other state hubs) is a more recent attempt to provide funding for the 'soft infrastructure' required to support the innovation eco-system across the state. New Haven was a lead receiver of the first \$1 million grant, in response to an RFP providing a series of programmatic initiatives designed to support some of the existing activities emerging at the local level.⁶³ However, these state initiatives are generally 'seed' funds, meant to leverage private-sector capital, and to grow sustainably over time. However, these amount to short-term political initiatives to demonstrate the state's commitment and may help with visibility for the specific locality, but these programs may not be able to meet the objectives given that the short-term investment time frame is unlikely to provide for longer-term growth, measured by long-term metrics (e.g. jobs).

The federal government has made progress in better organizing its economic development programs across agencies to pool funds and further incentivize firms in interconnected regional activities. With a few key appointments in specific federal agencies, the Obama administration has strengthened the efforts and effectiveness within the departments of Housing and Urban Development (HUD), Education, and Energy, and has initiated a few new organizations and tapped key leaders to bring the agencies into the 21st century particularly with respect to transparency and technology utilization. However progress has been less visible in some key agencies that have a direct line to the economy and existing economic development programs. For instance, the Secretary of Commerce has been an acting secretary since the beginning of the administration,⁶⁴ and the federal programs from this agency, including the Economic Development Agency (EDA), have been limited. Externally, several other U.S. agencies, such as the Small Business Administration (SBA) and HUD are where the majority of economic tools reside. Primary tools through which the funding is disbursed (outside of direct research grants) are through Small Business Innovation Research (SBIR) grants and SBA loans, administered by the SBA, but most of the work is directed by the lead client research agencies such as DOE, DOD, and others. HUD's longest, continuously run local grant program, initiated in 1974, is the Community Development Block Grant (CDBG) program, which provides funding to local governments in order to support local activities that lead to community development (such as social service agencies and neighborhood stabilization activities). There are many financing programs available from many federal/ state agencies that again aim to provide a financing gap for real estate and other community development projects that provide

⁶² Florida, *Ibid*

⁶³ As CEO of the EDC New Haven, the author was responsible for initiating and securing this grant funding in 2012.

⁶⁴ As the document has gone to print, Penny Pritzker, of Chicago, has been nominated to the Secretary of Commerce position, to be confirmed by Congress.

additional jobs in urban areas with high unemployment (e.g., New Market Tax Credits (NMTTC) and EB5 Jobs for Massachusetts from the U.S. Customs and Immigration Service). Each program has very specific program qualifications, mostly tied to job growth, and require numerous steps and often matching funding that also calls for additional administration and oversight, which can impede processes.

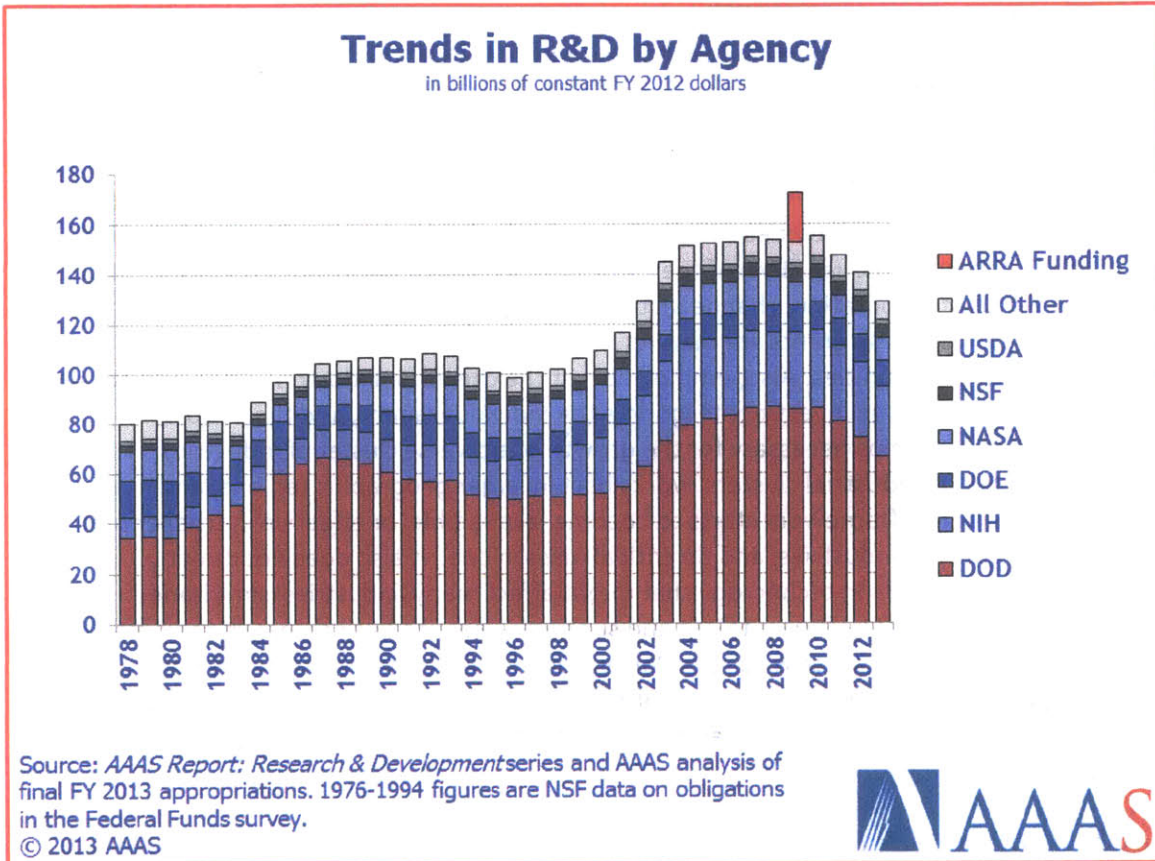


Figure 5: Overview of funding by federal agencies for R&D Funding as an example of investments into the innovation economy.⁶⁵ Please note that although the EDA investments do not directly go to R&D funding, the EDA annual budget is only \$304 Million in FY 2011.⁶⁶

The U.S. EDA's mission is "to lead the federal economic development agenda by promoting innovation and competitiveness, [and] preparing American regions for growth and success in the worldwide economy."⁶⁷ Innovation and regional collaboration are the key defining policy frameworks and appear often throughout the EDA's website. The agency's lens is very clear, according its 2011 Annual Report: "[The] American economy is in fact a collection of local and regional economies. The key to our national competitiveness is regional strength and competitiveness...when the right partners in regional economic ecosystems come together and increase their level of interaction that good things happen."⁶⁸ However, there is no mention of how these regions relate to each-other or the rest of the global economy, and how those ties

⁶⁵ <http://www.aaas.org/spp/rd/>

⁶⁶ Economic Development Administration, Annual Report to Congress FY 2011, 3

⁶⁷ <http://www.eda.gov/investmentPriorities.html>

⁶⁸ *ibid*, 2011, 5

shape specific regional economies. A quick glance onto their 'newsroom' website reflects the stream of grant activity that was dedicated to natural disaster responses (Hurricane Sandy, for example), which is in fact a critical role for the federal government—disaster response. However these efforts take human and financial resources away from other activities and potential programs. This sub-agency has been routinely underfunded, and underutilized.⁶⁹

There have been numerous attempts to pool smaller streams of money from a variety of agencies into larger grants, under 'guiding' frameworks, such as the Regional Innovation Cluster program, of 2011. However these funding pools are relatively small, and require complex multi-agency applications and reporting requirements (multiple applications for one project), or rely on capacity building at the local level without any appropriated funds. Perhaps more importantly these programs continue to support independent regional activities, and fail to recognize or incentivize activities that bridge multiple cities that might have more specific interrelated or common issues. Even if they stretch across state lines (often requiring unique and experimental 'collaboration' channels), they are still related to concepts of geographic proximity. Therefore these grants are missing an opportunity to help extend the learning activity between communities. Also, employing just the cluster or industrial views of places (via business support) to frame investments ignores the individual agent, and the historic foundation of partnerships necessary for the growth of a diverse cluster of industries. The Porter framework of 'industrial clusters' works best in larger geographic regions, and mature economies. The Porter framework starts to become less 'legible' or effective in smaller markets that have a diversity of industries, and no critical mass in one. It also does not directly recognize industrial shifts in technology that might affect many 'industries' simultaneously (i.e., all industries need IT/software talent and supportive service businesses), In their attempt to interpret a 'formula for success,' as the Porter framework has generated for larger economies, many grant-agencies are susceptible to fund new 'clusters' instead of existing ones, and miss out on growing critical businesses within a region that do not fit well in the proscribed clusters.

The Obama White House has been shaping multi-agency task forces and councils to address specific community development projects, and HUD, NEA and others are stepping in to convene and lead conversations about new programs that 'fit' the mission to effectively build the economy, such as the and the Strong Cities, Strong Communities (SC2) program of 2012.⁷⁰ This program is aimed at supporting key struggling urban economies with expertise and resources. As outlined in this author's conversation with U.S. Assistant Secretary for Economic Development, Valerie Piper, HUD has been focusing on institutional infrastructure and programs like SC2 in order to build capacity for grant recipients through technical assistance and better targeted existing resources, while leveraging additional private resources within cities. She mentioned that they have tried to keep funding tools flexible for local agencies, and to strengthen peer-to-peer advisory programs. Yet a series of constraints hamper more

⁶⁹ Perhaps the EDA should be reconsidered as a sub-unit of the Commerce Dept., and provided with a different 'coordinating' mission of economic development should be given to a broader umbrella organization that coordinates all related agencies from the departments of Commerce, HUD, and Education.

⁷⁰ At the publication of this document a one-year report on this program was issued. <http://www.whitehouse.gov/blog/2013/04/25/supporting-local-communities-building-capacity-and-cutting-red-tape>

'customized' approaches to economic development at the local level, including the lack of local data and methods to measure the effectiveness of investments, and lack of consistency across delivery zones. In this case, unfortunately no such thing as 'one size fits all' exists. HUD has worked diligently to gain the authority to create a percentage of program dollars and appropriate them in a 'rolled up' Transformational Initiative Fund that enables them to have a slightly more flexible funding stream to dedicate to HUD departmental priorities, primarily to help development organizations with technical assistance.⁷¹ This move has made grants more competitive, but has allowed HUD to pursue new strategic priorities such as economic development in distressed urban cores. One of the most critical constraints that the Obama administration faces in developing innovative, cross-agency programs, seems to be the hard-wiring of the Congressional appropriations committee structure—there is a mismatch between collecting agencies into initiatives, and where their line item-budgets get approved by different congressional committees, delaying any process of funding new programs. . Therefore, despite how innovative agencies are or could become, and how much consensus can be built around new, possibly more effective economic development programs, the Congressional appropriation authorizing committees will very likely not change, and therefore obtaining funding for new programs to bridge those deeper lines in the sand is difficult.⁷²

Fundamentally, perhaps the most promising contemporary efforts are the open data initiatives that may provide a long-term transformation of development and innovation. These efforts, as outlined in a May 2012 document, were launched to render transparent government activity and much effort was directed at transforming internal governmental systems so as to be 'ready' for this initiative. Viewing this effort chiefly as a tool to generate business and technological development, President Obama stated, "Treating the government as an open platform in this way encourages innovation. Just look at how the government's release of GPS and weather data fueled billion-dollar industries. It also makes government more efficient and able to adapt to inevitable changes in technology."⁷³ The Obama administration was also the first to initiate a federal 'chief information officer' post chiefly responsible for making the federal government's information technology systems more nimble, useful and instructive in terms of identifying and collecting data and developing metrics for measuring the effectiveness of programs.

How do we measure an Innovation Economy?

Currently, in the macroeconomic environment, as tracked by multiple government agencies, we have a variety of indicators of economic progress, though they seem to operate in an 'aggregate' sense, reporting quantitative indications of progress or lack thereof, rather than making any real qualitative assessment about the economy, or even more detailed quantitative pictures that people can understand as it relates to their daily experience. What is needed seems to be a critical re-assessment of how we measure innovation and therefore better map our progress.

⁷¹Conversation with Valerie Piper, 3/4/13

⁷² HUD's primary tool — its Community Development Block Grants program, offers a lifeline to cities, but are so localized and appropriated through state, then city agencies, and executed by local legislative bodies that generally they have few resources for effective means to identify viable candidates (i.e., companies? metrics?), and to monitor and benchmark them.

⁷³ Steven VanRoekel, "Roadmap for a Digital Government" on White House Blog, 23 May 2012. (Sung 2013) <http://www.whitehouse.gov/blog/2012/05/23/roadmap-digital-government>

Looking at GDP per capita, perhaps the most appropriate measure of proportional activity in a place, which covers a broad variety of economic 'inputs' and 'outputs' and is generally a measure that lags actual activity. However, even after decades of use, the GDP measurement tool has not fully been calibrated with the innovation economy. In April 2013, an NPR report alerted the author that the GDP will be adjusted upward, not to reflect a specific increase in productivity, but to finally include R&D spending as a measure of inputs/investments into the economy. Further research confirmed this fact, and as of July 2013 the GDP will finally reflect the core innovation activity.⁷⁴

Even data on the number of existing and new 'jobs' and unemployment data are long-term indicators as investment and activity do not directly translate into jobs gained immediately; furthermore, as mobility and multi-locational trends continue, jobs may not even be registered in the same place where the work occurs, especially with large corporations and multinationals. As mentioned earlier, much economic activity may not be captured in specific jobs data, but is supportive of the innovation economy as a whole. As companies disaggregate, and consulting/freelance networks increase, we will likely see a further diffusion of jobs per company decline, and the number of companies increasing, but which will be less geographically proximate. There are a number of additional measures being employed more recently to try and 'read in' the nuances within the economy, such as 'quit rate' to demonstrate people feeling 'free' to move on from existing jobs that may not fit, since there are fewer explanations to this transformative and unique period of slow economic growth.⁷⁵

Additionally, Glaeser and Kerr argue that innovation and job growth is highly correlated with a plethora and diversity of smaller firms. Cities with more firms per worker had greater levels of job growth than those with only a few large employers. Additionally, "once entrepreneurship gets established, it tends to be self-perpetuating."⁷⁶ This may indicate a way of measuring the culture of entrepreneurship—by measuring new business starts per capita.

Our standard measure of innovation 'productivity,' has been based on 'patents' or licensing activity, but increasingly, these metrics not appear to measure the valuable part of innovation—the moment of knowledge transfer. Patenting is a legal process that fully documents the intellectual property of an invention, but many innovations that occur prior to an official Intellectual Property (IP) filing may emerge as unique products/services, and/or may catalyze new lines of inquiry that would result in a later time in a patent. Therefore patents and company formation seem to be just the tip of the iceberg, of what is actually happening, and do not reflect the environment in which the innovation is happening (the environment of business activity or physical context being perhaps more conducive to the innovation act).

The field of bibliometrics, which studies quantities and patterns in published papers, tends to gain an additional perspective of innovation economy activities, but publishing articles on

⁷⁴ Albert Sung, "Seeking Alpha: US Government Invents New Way of Calculating GDP", website <http://seekingalpha.com/article/1368001-u-s-government-invents-new-way-of-calculating-gdp>

⁷⁵ Apparently this is a rate that is more robust in a better economy. Currently at 1.7%, this rate has increased recently, which is a good sign, but has been higher in the past. Sabri Ben-Achour, "Why the Fed Wants You to Quit your Job" on Marketplace Public Radio. 2 May 2013, <http://www.marketplace.org/topics/economy/why-fed-wants-you-quit-your-job>

⁷⁶ Glaeser and Kerr, Harvard Business Review.

innovation processes and products is not consistent across innovation industries. As mentioned, examining articles published does show an increase in collaborative submissions over time, across jurisdictional boundaries, but makes that data hard to 'match' with other specific location-based data (such as tax filings or jobs). More importantly, some areas are more prone to collaboration and knowledge transfer activities. As described in the Scholarship/Theoretical Review section, many studies point to factors of geographic proximity, spontaneity, regional events, and social networks that promote regional scientific collaboration. As defined by the private research group Science-Metrix in their study on collaboration potential, using MSA counties and cited/published paper data, a high collaboration rate is an indicator of a productive innovation culture. More importantly, the research showed that smaller MSAs (population) are keen to collaborate, but in proportion (i.e., scale) they are in fact significantly 'collaborating'. Currently, the top 10 collaborative regions, when adjusted for size, are Durham, Baltimore, Seattle, Tucson, Washington, D.C., Boulder, New Haven, St. Louis, San Francisco, and San Diego,⁷⁷ incidentally all considered 'secondary' markets.

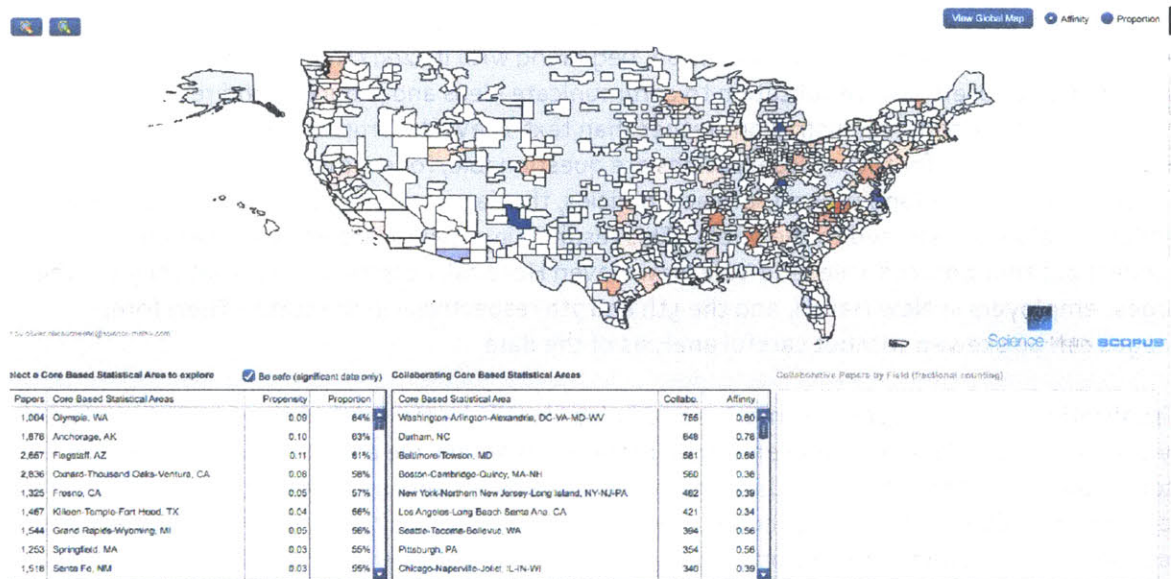


Figure 6: This MSA Explorer tool, created by Science-Matrix, is an interactive map that looks at the propensity to collaborate based on published papers with multiple authors. This map shows Winston Salem's propensity to collaborate and with whom. <http://www.science-metrix.com/MSAExplorer/>

Currently, super-entrepreneur and TED talk presenter Brad Feld is working on a book that is redefining critical metrics for startups (and entrepreneurs) to consider in their process of measuring success and setting appropriate growth milestones. At this writing, it is unclear if these metrics could be extrapolated to a broader mapping of productivity, but it is increasingly apparent that by being able to visualize and 'measure' the granular level of activity in the economy, there might be better valuation of the impact of innovation on the economy. In a similar vein, Sandy Pentland, MIT Media Lab professor, and many other leading scientists are studying how Big Data and the analytics of new technology 'fingerprints' could lead to reliable

⁷⁷ Beauchesne and Archambault, Conference Presentation by Science Metrix

short-term (and quicker) reflections of economic activity. Even world-leading economic analysis engines such as the International Monetary Fund (IMF) have released materials recently discussing the limitations of GDP and other macroeconomic measures, designed for keeping track of economies on an overall long-term growth trajectory, to show true activity in the economy.⁷⁸

Economic data gives shape and an identity to cities—it is increasingly how we ‘see’ the city. The problem with industry-defined places though, especially if they are small, is that the data is messy, and hard to gather, and may not always provide an accurate picture of the place, especially for cities with geographically dispersed corporate activity. Hence the axiom, “the more local you go the harder it is to find good data”. The increase of data visualization has become a better tool for understanding the real activity of a place. Emerging tools and media channels that specialize in information about the economy (e.g., Good Magazine) have further propelled a popular understanding of our economy (particularly considering the ease of accessing information). Apropos to this, the New York City Economic Development Corporation (NYCEDC) even has an annual competition to convey information about the city through data visualization technology such as graphic charts and pictograms which illustrate key data points. The Obama administration, beginning with its 2007 the campaign start up until today, has used data visualization to communicate ideas and progress, and regularly posts information in the form of illustrations rather than text-heavy documents. However, the underlying data sets for these visualizations are questionable; for example, due to U.S. Department of Labor (and others) ‘privacy’ policies, the data for particular entities are often hidden in data sets released to the public. This resulted in a map of industrial affiliations in Connecticut that omitted Yale, and Yale New Haven Hospital, despite the fact that they are the largest employers in New Haven, and the 5th and 7th respectively in the state. Therefore, images can be skewed without careful analysis of the data.

Visualization contextualizes information and helps identify ‘patterns’ that may not be as evident in specific data sets, or even simple mono-dimensional pie and bar charts. Often the story is the relationship between datasets, not just the data itself, especially in complex economic trends where so many factors are interrelated. Especially with respect to clustering of economic entities, and more importantly, geographic connectivity, we will continue to see an explosion of this visualization technique, which may increase our ability to render visible some of the more ‘invisible’ economic agents and data.

What are the Critiques/Concerns and Challenges to Connecting Urban Economies?

Most critically in this evaluation of processes that might be working is the fact that there remain hurdles to fully implement a more ‘all boats rise’ philosophy of economic development, that is, collaboration and cooperation between cities and regions rather than competition. Recent economic development efforts have aimed to network cities so as to cooperate and to ‘learn’ from each other, but these have not aimed for or achieved permanent connectivity, or a leveraging of cities’ existing relationships to other cities. Numerous miscellaneous networks, particularly those at the national level, exist, as described in the previous analysis on

⁷⁸ Manik Shrestha and Marco Marini, Quarterly GDP Revisions in G20 Countries: Evidence from the 2008 Financial Crisis, IMF Working Paper, March 2013, p 3.
<http://www.imf.org/external/pubs/ft/wp/2013/wp1360.pdf>

'networked cities' but it is not clear that they have provided much direct investment in peer-to-peer advising and long-term, strategic influence via political involvement. However, those industry network national conferences provide platforms for increased dialogue directly focused on what's happening in the economy, what cities might be doing about these trends, and reporting on the current levels of activity in power point sound bites.

Local officials have a historical, cultural and legal mandate to serve the people who elect them, and by broadening a resource base to outside entities, especially historically 'competitive cities,' can feel threatening to some officials. Cities located in close proximity, such as Boston and Cambridge offer evidence of 'poaching,' companies. To the outsider, these are the 'same economies,' but due to the jurisdictional frameworks, a move by a company (and the jobs it creates or takes) from one city to next is front-page news.

Competition between cities is certainly quite prevalent especially for cities close in proximity; especially when local and state-level dollars are at stake. Mayors generally emanate from one part of the state, and despite their interest in being fair to the entire state, they are naturally more entrenched in relationships in their 'known' (i.e., local hometown) contexts. Even regionally, across state lines, competition between cities to woo corporations (and jobs) can be intense. As Seth Pinsky of NYCEDC reported, cities adjacent to NYC, from Newark to Stamford, compete for jobs and economic develop dollars, despite the best of intentions.⁷⁹ It is one large economy, but any event of a company moving could be the make-or-break moment for a political career for multiple jurisdictional mayors and at least three governors.

The context for shifting frameworks from independent jurisdictions to a more cooperative complementary approach is like switching from 'left-handed' to 'right handed' cars—the system has to be changed systemically and simultaneously for the change to work. Due to the interrelationship of so many factors that drive the economy, it would be impossible to just Added to this is the trepidation city leaders feel in being the 'first mover' in the economic chess game. However, any proposal for a shift in thinking cannot ignore the conditional framework for why this paradigm might take more time to implement.

Leadership: Whose job is it anyways, to curate the innovation economy?

Local governments are stymied by the entrenched and inefficient mindset of "let's help just our own community", and federal level activities are constrained by current debt levels and political priorities for distributing resources, hindering all efforts to support and accelerate the innovation economy. Perhaps officials on all levels should recognize that 1) this "help just our own" mentality, 2) competition between cities should maintained only to incentivize better governance, catalyze better use of resources, and increased quality of life for cultural differentiation, 3) multiple levels of jurisdictional oversight, and 4) that no one organization can fulfill all relevant needs and conditions all hinder real economic progress. This four-fold recognition also requires an awareness that no government or organization can operate in a purely vertical or horizontal manner—and that effective economic development must operate from the viewpoint that our economy, on all levels, functions as an intricate network where every hub is mutually dependent upon each other. As Elinor Ostrom has said in her Nobel-prize winning work regarding the 'commons' of the economy, "Decades of research demonstrate

⁷⁹ Conversation with Seth Pinsky 4/15/13

that a variety of overlapping policies at city, subnational, national, and international levels is more likely to succeed than are single, overarching binding agreements. Such an evolutionary approach to policy provides essential safety nets should one or more policies fail.”⁸⁰

Similarly, Henry Etzkowitz, in his ‘triple helix’ model, illustrates the complexity of the economic system with multiple institutional actors (government, corporations, and universities) as a mutually dependent genomic structure like DNA—three strands intertwined.⁸¹

Historically, the public and many scholars have assumed that the government plays a lead role in the economy. However, we must question whether the government just as effectively influence the innovation economy because it cannot readily control the production of knowledge, knowledge transfer, and resulting business development. Brad Feld, speaking for the success of localized innovation economies in his Boulder Thesis, notes the need for entrepreneurs to lead the way, in a grassroots effort, and to shape and control the innovation economy⁸². He questions whether the government is best suited to be a convener, bringing private and public actors in the economy together. “[The] [g]overnment and universities ... are feeders, not leaders. Feeders are important, but they are different – and play a different role than leaders. A convener has much more leverage than a connector.”⁸³ However, as a company matures, the role of the government and/or university (conveners), could transform into a funders/connectors, and ultimately customers.

Glaeser speaks about the need for attracting talented people to cities and innovation hubs, and then “getting out of their way,”⁸⁴ suggesting that they know what to do to get things done. My own experience as the director of a mid-sized Northeastern city’s economic development agency has shown that if the government can act as a convener to bring people together regularly, especially those not typically in contact, it could recognize great success in motivating new initiatives and helping facilitate knowledge transfer. In effect, the government can support market inefficiencies, such as populations not having the opportunity to mix, which is one of the best roles of government. Therefore, the government, as a convener, should also work to connect cities’ resources, people, and social, economic and political activities to other cities (both geographically proximate and distant), and that in the end, this will make the city more confident and productive.

The key perhaps lies in the potential ability to navigate, organize functionally, and mend broken threads between the interrelated infrastructures—local, regional, federal and public/private—and to act as a meso-scale ‘conductor’ so as to ‘curate’ the innovation economy. However, this conductor could be affiliated with many traditionally silo institutions, or clustered institutions. Most importantly the conductor should be recognized by many institutions as an extension of their own desires and efforts, a neutral party.

As the following analysis will show, there is quite a bit of overlap and disjointed activities in the spectrum of entities working within R&D and the technology transfer process. These actors in the innovation economy are not just a major component of the GDP, but more importantly, are

⁸⁰ Elinor Ostrom, Project Syndicate Blog.

⁸¹ Henry Etzkowitz, Numerous Articles & Institute.

⁸² Brad Feld, Startup Communities.

⁸³ Ibid

⁸⁴ Edward Glaeser, Triumph of the City, 260.

seed investments and processes that lay the foundation for the economy. Once the foundation is created with initial startup businesses, a snowball effect occurs whereby economic activity grows by the addition of supportive retail and professional services to serve the initial companies, so that over time the startups and incubators grow into mature corporations (e.g., drug companies, manufacturing) all the while attracting more businesses. Therefore the system that creates this pipeline, and that which supports its future fruits, should be most efficient and calibrated to the factors that drive the economic systems.

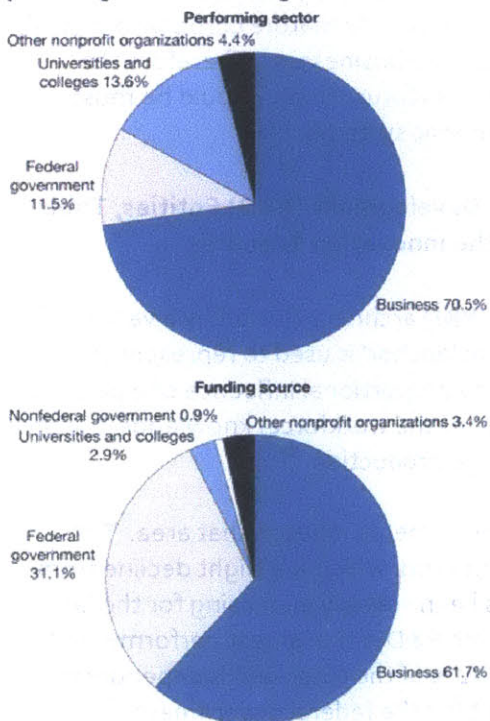
V. IDENTIFICATION | Leading Anchors—Research & Development (R&D) Entities, Their Increasing Interconnectedness, and Contribution to the Innovation Economy

A primary component of the innovation economy is the R&D architecture, led by a variety of entities within technological R&D. In this study, the term 'anchor' is used to represent the institutions described below, as it implies the primary and proportional influence of a particular entity within the local economy, as measured by the size of the workforce, knowledge-transfer activities and/or intellectual property output of knowledge production.⁸⁵

Most evaluations of R&D activity can be measured by investments made in that area. The overall budget for R&D in 2009 was estimated at \$400.5 billion, which is a slight decline from the previous year, a lag from the financial crisis, but has been steadily increasing for the last decades. This is about 2.9% of the US GDP. The corporate R&D is the largest performer of US R&D, estimated at 282.4 billion in 2009, approximately 71 % of the total, and independently does a significant amount of investments, now more so than the federal government.⁸⁶

⁸⁶ U.S.National Science Foundation, Science and Engineering Indicators 2012, Chapter 4. R&D: National Trends and International Comparisons. <http://www.nsf.gov/statistics/seind12/c4/c4s1.htm>

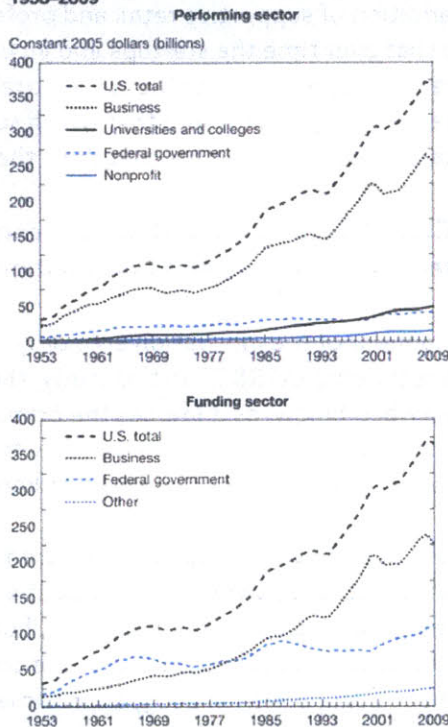
Figure 4-3
Shares of U.S. total R&D expenditures, by performing sector and funding source: 2009



NOTES: Some figures involve estimates and may later be revised. National R&D expenditures are estimated to be \$400.5 billion in 2009. Federal performing sector includes federal agencies and federally funded research and development centers. State and local government support to business is included in business support for business performance.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series). See appendix tables 4-3 and 4-7.

Figure 4-4
U.S. R&D, by performing and funding sectors: 1953-2009



NOTES: Some figures involve estimates and may later be revised. Current dollar figures are converted to constant dollars based on the implicit gross domestic product price deflator. Federal performers of R&D include federal agencies and federally funded research and development centers. Other funding includes support from universities and colleges, nonfederal government, and nonprofit organizations. State and local government funding to businesses is included in business support for business R&D performance.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series). See appendix tables 4-3 and 4-7.

Figure 7a and 7b: A Snapshot of the R&D Investments in the Economy, and Main Drivers. US National Science Foundation, Science and Engineering Indicators 2012

Left: US R&D Expenditures by performing 'Anchor' in 2009

Right: US R&D by anchor trend over time⁸⁷

Historically, as has been well documented, anchor institutions play a major role in catalyzing and sustaining an innovation economy. In the classic examples of the Route 128 high tech and biotech cluster outside of Boston, nurtured by MIT alumni and the new technologies coming out of MIT, along with the well established Raytheon, and the Palo Alto story growing out of Hewlett Packard and Stanford University,⁸⁸ it is clear that not one company with or without government support designs a system in its totality. Organizations are linked in a dynamic shifting pattern of 'hierarchy' over time (i.e., various lead institutions acting as the driver at different points in time, sometimes corporate, sometimes the entrepreneur, sometimes government). Additionally, the geography of these lead institutions, and their patterns of

⁸⁷ <http://www.nsf.gov/statistics/seind12/c4/c4s1.htm>

⁸⁸ Anna Lee Saxenian, and others which generated a multi-generational growth that is much emulated by 'cluster wanna-be's everywhere'

innovation productivity over time spread more broadly across a city and a region (and beyond state and national boundaries), in parallel with the overall shifts in the economy, and will continue to disperse as technology-enabled learning expands.

To more fully understand the lead anchor's role amid recent economic and technology trends, and to frame its efforts into a neat 'typology,' a lead anchor can be any of the following:

- **A Startup R&D organization:** Independent entrepreneurs & early-corporate entities. Although startups and independent entrepreneurs are not typical 'anchors' due to their scale, they are innovation economy leaders because they take the first steps and they take risks. Especially for technology startups, these early growth companies are themselves pure R&D led by the entrepreneur
- **Corporate R&D:** Multinational corporations that have an abundance of internal R&D resources, can patent new ideas, develop internal technology and products, partner with research universities and support new ventures (that could be acquisition targets).
- **Institutional R&D (where emphasis is on pure research):** Universities and research institutes (public and private) that also have internal academic and corporate sponsors and/or that: partner with outside organizations on R&D activities that generate new ideas and/or published research, convene academic conferences, patent new technologies and produce new businesses in a direct or secondary way (e.g., by maintaining relationships with former students engaged in startups).
- **Government & Private R&D:** (Also called FFRD: Federally Funded R&D facilities) Contract research and development organizations. This research focuses on government-owned or -sponsored laboratories such as Draper Laboratory in Cambridge, Mass., Battelle Energy Alliance, in Idaho Falls, and Sandia National Labs (a subsidiary of Lockheed Martin Corp.), in Livermore, Calif. and Albuquerque, NM. These entities are 'anchors' due to their receipt of significant funding from the government investment into R&D, the talent and physical resources they own. However, they have been historically more 'passive' anchors, as described further below.

As the U.S. economic landscape has lurched from expansion, to crisis, to contraction and slowly back to expansion in the past two decades, core organizations/firms and government entities have not reacted well to new conditions. No institutional 'entity' is immune from transformative change. This creates a great opportunity to systematically rethink the interface of these anchors and their relationship to the economy. In fact, these changes seem to come as a surprise rather than expected cyclical events and they have been unprepared to cope with these shifts; no plans seems to have been set in place before the contractions started. In response to significant economic shocks, each organization within a network also either contracts or expands their reach to stabilize. Instead of expanding internally, some corporations look to outside smaller firms and research institutes to develop their technology (i.e., Sikorsky, P&G). Universities looking for additional streams of funding have taken on contract R&D and laboratory work for firms in need (e.g., the MIT Media Lab's partnership with Citigroup); private contract R&D labs have taken on service roles for new technology sectors, or have become lead conveners between government, corporations and smaller labs (e.g., Battelle, Draper).

Broad technological advancements have enabled new R&D activities to be layered onto old models, and these R&D activities have become more distributed across regions, nations and the globe, as opposed to centralized efforts. Factors contributing to the overall multi-locational trend for R&D sites include:

- Mergers & Acquisitions and Partnerships between larger and smaller firms, and universities located often across states, countries and continents.
- New cooperative initiatives and the institutional restructuring that have recently emerged between large corporations and universities not proximate (the formation of research institutes).
- Increasing networked activities to expand companies' knowledge base and increase the speed of R&D process (e.g., P&G & InnoCentive)
- Increased mobility and lower-cost transportation options
- New technologies from communications to imaging and networking technology have created additional means to collaborate long distance (though this does not entirely replace the need for face-to-face interactions.)

Each of these anchors has a differentiated set of activities that would constitute innovation activities, and therefore there are few metrics that are effective at seeing the innovation productivity across all sectors. For example, startups might be measured in web visitors as they build a customer base, whereas corporate R&D could be evaluated on jobs created or money spent, government R&D agencies might be evaluated in contracts. However, there has been a consistent key performance indicator in the evaluation and quantification of intellectual property, as seen in patent growth. As suggested by Florida in his essay, *The Density of Innovation*, "The density of patents is closely associated with key regional economic outcomes such as regional wages, regional incomes, and regional economic output."⁸⁹ In the same article, there was a similar evaluation of high-tech worker per kilometer, leading to similar conclusions, however this document will focus on the broadest amount of innovation, not exclusively to high tech. Recent changes in the patent laws, and trends in the economy, as discussed later, may affect the overall activity of patent filings. Most importantly, these anchors described in this section are the primary producers of patents within a community and the overall economy.

⁸⁹ Richard Florida, "The Density of Innovation" on *The Atlantic, Business Blog*, 09/21/2010. <http://www.theatlantic.com/business/print/2010/09/the-density-of-innovation/62576>.

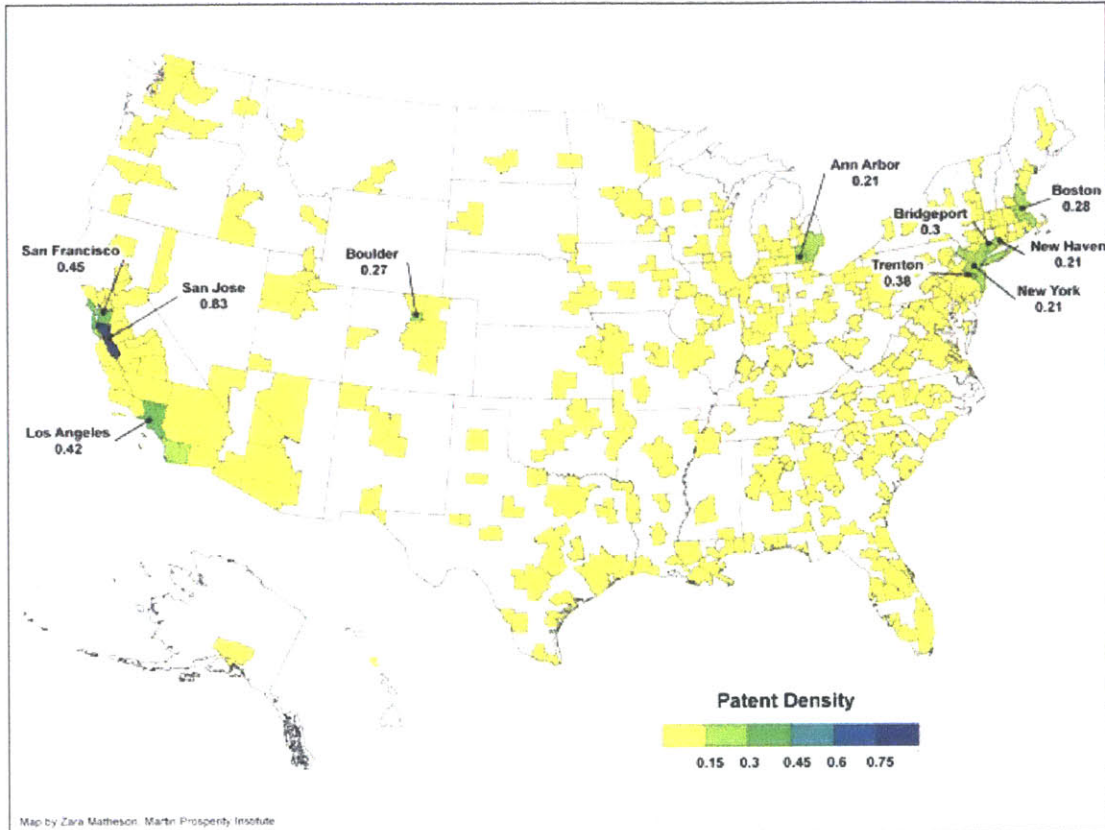


Figure 8: Chart shows the amount of patents per kilometer, conveying the innovation activity as it relates to patents. (Source USPTO)⁹⁰

The following sections outline observed and researched trends for these different innovation 'anchors,' and the information is compiled in a survey of the current status, and indication of what might be changing as the economy evolves.

Startup R&D

Role in Innovation Economy

A startup by its nature is a company in R&D mode—not just doing R&D to explore a process or technology and to produce a product, but also the organizational design itself—a work in progress. However, in this phase, the majority of the organization is devoted to R&D. One of the most critical agents in the innovation economy, the startup is seen as “a canary in the coal mine” in the cultural context, because it signals the innovation capacity of a place. As detailed in the scholarship section, economic success is often predicated on a consistency of ‘new firm creation,’ to support a robust pipeline of future, larger firms. Scholars have noted that the ‘heart’ of growth in the economy is a nation’s small startup businesses.⁹¹The innovation

⁹⁰ <http://www.theatlantic.com/business/archive/2010/09/the-density-of-innovation/62576/>

⁹¹ According to the 2012 report ‘Frequently Asked Questions’ from the SBA (Small Business Administration), Small Businesses, firms less than 500 employees, make up 99.7% of U.S. employer firms, and 64% of net new private sector jobs. It is more likely that small businesses produce ‘patents-’ 16 times more than large patenting firms.

economy is the pipeline of startups that emerge from universities, or spun off of corporations, ones that provide opportunity for high growth. According to the SBA, these firms comprise about 40% of the net new jobs created, but that their average employment rates have been declining over the past decade.

Fiona Murray and Bill Aulet, of the MIT Martin Center for Entrepreneurship, make an even finer distinction of entrepreneurship in “A Tale of Two Entrepreneurs: Understanding Differences in the Types of Entrepreneurship in the Economy.” Innovation-Based Entrepreneurship (IBE) focuses on high-growth potential companies that develop and/or bring to market new innovations on a global scale versus Small and Medium Enterprises (SMEs), which help drive innovation and competition, but are less likely to scale up significantly, and don’t tend to survive if moved.⁹² While this section focuses primarily on IBEs in the innovation economy, we recognize that many SMEs produce innovations over time in their services, locally, and even spin-offs and additional products that become high-job potential companies locally/regionally—important contributors to localized economies with a diverse workforce. For example, Chabaso Bakery, in New Haven is a large bread baking company with a sales reach across the U.S. East Coast, employing 250 people locally (a large firm for New Haven). Chabaso Bakery grew out of a small café bakery, named Atticus, an SME according to this distinction, that still operates on a small scale.

Given this example, it stands to reason that if IBEs produce jobs locally and connect globally, then jurisdictional authorities should recognize their connection to the larger economy, and that the IBEs’ jobs are potentially fluid because talent retention and stimulation of continual job creation are key roles for enhancing local economies. In either case, continual new firm creation, both SME and IBE, plays a critical role in sustaining a growing economy, and jurisdictional authorities should recognize this and support them.

Nationally, there is emerging popular support for startups, and it has been growing in popularity since 2008. This awareness and increasing financial support was clearly triggered by the 2008 financial crisis, but also developed around a set of regional initiatives, and ‘trending’—it’s cool to be a startup right now! The Obama administration announced in January 2011 a set of programs to improve access to startup resources, including ‘Startup America,’ initiated by Priceline founder Scott Case, aimed to support public-private initiatives, including promoting their visibility and helping startups and their communities to grow.

Cities and states anxious to see growth in their emergent startup scene have done a substantial level of research and ‘visiting’ that has promoted them to mature clusters, such as the Cambridge Innovation Center complex and NYC’s General Assembly, in action. The growth of incubators and accelerators from public and private sources are further proof of policy maker’s interest in creating hospitable environments for small business development. For instance, the service industry (e.g., lawyers, design firms, and accountants) has expanded in many areas as it has expanded its reach to new innovation clusters (McKinsey, etc.); furthermore, an industry of startups has started to document and build visibility of entrepreneurship clusters thus ‘mapping their own community.’

⁹² Bill Aulet and Fiona Murray, “A Tale of Two Entrepreneurs: Understanding the Differences in the Types of Entrepreneurship in the Economy”, Unpublished Draft, January 2012, MIT Sloan School of Management

Locational Startup Trends

Given the new macro mobility trends, startups are now building teams of employees based in and with ties to multiple locations, and some regularly work in multiple locations. Beyond simply 'outsourcing' streams of a company's work through networks of engaged consultants, which is very common in the service industry,⁹³ the geographic dispersion of startup ventures are becoming more prevalent, particularly in areas like the Cambridge/Boston region, with numerous universities, research centers, tech and biotech incubators and entrepreneurial programs that draw bright students and professionals from across the world. Due to the growing diversity in educational programs to suit all interests and more importantly, schedules, including online and distance learning, satellite extension programs, weekend professional programs, cofounding teams of entrepreneurs have formed that include students and professionals from various schools/programs, and diverse demographic backgrounds and geographic home bases.

As can be seen in the statistics related to the worldwide 'Startup Weekend' phenomenon, a weekend workshop designed to catalyze new teams that could lead to new business ventures, people travel across states, regions and even nations to attend intense weekend courses that fit their busy work/life schedule⁹⁴. For example in New Haven's 2011 inaugural Startup Weekend attracted 70 attendees from five states and eleven schools (only 30% were students), forming ten to twelve startup teams. Even if these teams do not 'stick,' they serve as dry runs for future ventures, and help extend personal/professional networks. According to Startup Weekend, over 36% of startups initiated via Startup Weekend teams were "still going strong" after 3 months and roughly 80% of participants planned to continue working with their teams or startups following the training.⁹⁵

Emerging are many web-based site resources that also act as 'matchmakers' for ventures, irrespective of geographical location. For instance, Cofounders Lab, which helps individuals interested in forming startups, was formed by two individuals in Rockville, MD (outside of Washington, DC) who met at a local MeetUp.com gathering on startups, and recognized the need for startup founders to look nationally (and internationally) for partners in startup ventures. In fact, they have expanded in the last year (by acquisition) with other similar resource and now offer both offline and online services. With a sophisticated data-driven engine, this site has shown more traction than other sites, but most importantly, it offers individuals access to a broader talent pool, and reinforces the availability of talent across the globe, and it also highlights the need to balance online and offline interaction.⁹⁶

Locational trends of the innovation industry for startups are in transition. Historically centered around high performance 'innovative' ecosystems such as Cambridge/Boston and

⁹³ Networks of consultants further extend the reach of service industries to new locations, often leading to additional referrals, new venture creation, and the dynamic 're-constituting' of project-specific teams.

⁹⁴ <http://www.wikipedia.org/startupweekend>: As of October 2012, 672 Startup Weekend events had been held, involving 57,000 entrepreneurs across 300+ cities in 100+ countries; over 5,000 startups have been created. The Kauffman Foundation, Google and Microsoft are sponsors

⁹⁵ <http://www.startupweekend.org/about>.

⁹⁶ <http://www.cofounderslab.com>

Silicon Valley, more of these activities are occurring in virtual space and in smaller cities that may have not had a reputation for being a start-up hub. In fact there has been more recent 'popular' press on the explosion of activity in second-tier cities such as Austin, TX, Albany, NY and Raleigh, NC, and increasingly the finance world is recognizing the growth potential in these smaller, more affordable locales, where young professionals which do not require extremely high salaries since the cost of living is so much lower than large expensive cities like New York and San Francisco. Although these emerging scenes are still nascent in the evolutionary time period, as illustrated by the theory of clusters (see scholarship section above) these overall ecosystems require time to build critical mass, but when they emerge, their advantages become quite visible. As reported in 2012 by CNN Money in an article of 'Cities Where Startups Are Thriving,' "Say "startup" and most think Silicon Valley, Austin or Boston. But investors and entrepreneurs say a new group of startup cities is emerging — some in unlikely places.⁹⁷ The cities profiled are Boulder, Cincinnati, Nashville, Provo, Omaha, Des Moines, all of them regionally critical, but due to their size may be limited in their resources and networks without looking externally.

Multi-Locational Firm Examples & Output/ Growth Models

It is not just the larger corporations that are increasingly locating across multiple locations. Smaller startups and Internet-emergent-fueled companies are also increasingly located across multiple places, especially technology startups, and because early-growth-stage companies are heavily involved in R&D. For example, an early leader in online collaborative software, 37 Signals, famously announced that it does not require employees to work in the same location, and has successfully recruited talent from across the globe, in cities where professionals want to remain; it has 36 employees located across many locations, 27 different locations since their beginning in 1999.⁹⁸ Their effort to recruit the best 'talent' pool prompted this diverse set of locations. Clearly this multi-locational strategy demonstrates their core product's strength, but also illustrates a broader trend as founders and talent want new professional opportunities, but more often do not want to relocate for various personal, family and professional reasons, and they do not need to.



A map of where 37signals employees live/work ([larger version](#)).

Figure 10: map of where 37 Signals live/work early on, where 16 company employees lived in 9 different locations⁹⁹

⁹⁷ Jose Pagliery, "Best Cities for Startups", CNN Money/Business, 27 Nov 2012, <http://money.cnn.com/gallery/smallbusiness/2012/11/27/startup-cities/index.html>

⁹⁸ David, 37 Signals Blog: Signals and Noise, November 2012

⁹⁹ Matt Linderman, "Where 37Signals Employees Live/Work" on 37 Signals Blog: Signals & Noise, 8 September 2009 <http://37signals.com/svn/posts/1894-a-map-of-where-37signals-employees-livework-larger-version>

Although the companies may incur costs for some additional travel, and digital technologies to connect their employees regularly, they are also able to gain expertise and the best fits for their organization that boosts their productivity. These are not just firms with satellites, but truly multi-locational entities, with a variety of activities happening in each location, and key leaders dispersed. However for certain tax or legal reasons they might need to define a 'headquarters,' however this is 'in name only.' Although startups, or digital technology companies may have more tendency to operate 'multi-locationally,' it is not exclusive to these sectors. All industries and all scale companies are experiencing further geographic dispersion, sometimes organized around functional areas, but as outlined in further sections, this trend is also in transformation.

The cofounders of the multi-locational firms Hadapt (based Cambridge and New Haven) which provides large commercial scale big data processing capacity, and Bottlenose (Amsterdam, Los Angeles and Silicon Valley) a symantec web company, are physically located across regions/eco-systems although the cofounders developed relationships with each other when located in a single place such as while at university or an earlier job. Personal and professional reasons may have pulled them to different locations, but the strategic decision to remain as a company was supported by increased connectivity, and more importantly, by the *advantages* of being based in multiple locations. These startup cofounders recognize that they can pick and choose particular advantages like different locations, and dividing work functions to align with workers' backgrounds and interests, and select eco-system support structures, cost structures, and even time/focus advantages.

Formed at the Yale Entrepreneurial Institute in a match meeting between a computer science technology researcher and business entrepreneur with a technology background, Hadapt organized their distribution of work to suit both personal and professional contexts for them. One co-founder is located where he teaches (Yale in New Haven) where he has a well established quality of life, social and professional networks and family, and the other co-founder is located where he had gone to school (MIT in Cambridge), and where an important source of the firm's talent is located.

Bottlenose however, must straddle multiple time zones and mobility schedules to connect both virtually and physically. However, as reported by the Amsterdam-based cofounder, a software developer, this 'distance' often creates better productivity and focus on core activities. Given the industry they are in, a semantic web for a global marketing services clientele, the distributed organization works well, more effectively than it might in another type of industry. In fact, CTO Dominick Heide has suggested that he is more productive being remote from the organizational management and more connected to other colleagues in the industry (many in Amsterdam). This is a common theme throughout the emerging technology space, and current financing and development support tools, both public and private, influence decisions made by these co-founders. For example decisions about financing, where to file business incorporation activities, what promotes ease of travel and access is driven by what is most advantageous to the company from multiple dimensions, not by what economic development policies are in place.

Corporate R&D – Aligning Corporate Goals with Innovation Eco-System Needs to Benefit Localized Economies

As pointed out in an Economist article about the recent rise in corporate R&D efforts worldwide, “knowledge spillovers are good for economy as a whole, but bad for firms that made the discovery.”¹⁰⁰ Herein lies a particularly complex interrelationship between the municipal need to spur additional innovation for the public good (i.e., economic growth), and the industrial incentive to create this innovation, given the need for increasing profitability for shareholders, especially if they will continue to shoulder a greater share of R&D than the public sector. As The Economist pointed out in a recent article, since corporate R&D is increasingly “leading the way” more than government- or university-sponsored R&D (in terms of real dollars spent), it is still important for policy makers to ensure that private R&D continues to thrive, as the public good from the activity may outweigh the private benefit. Public policy instrument “influencers to R&D spending: {are} tax treatment, merger policy (mergers reduce r& d growth rates), shareholders”¹⁰¹ As corporate organizational structures become more complex, and their models for R&D shift, it will further complicate the corporate role, existing and potential, in the economy.

Based on the National Science Foundation Report on Science and Engineering Indicators 2012, Corporate R&D spending totaled 282.4B in 2009, which is approximately 71% of total US R&D investments. From the previous images, the proportion of spending can be understood to be critical to the economy, and it is growing. Additionally, the business sector performed 58% of applied research, which is the majority of all performers.¹⁰² R&D spending by Corporations is generally considered a ‘long term’ investment, but the spending varies significantly by sector, and has become increasingly complex (with respect to technology transfer) due to the increase of global corporations and collaborations with industry and universities worldwide. These trends will inevitably affect a corporations integration of knowledge transfer activities from R&D into the local environments.

As Michael Porter’s framework for shared value suggests, corporations can reap greater benefits in the long term if they look at their role systemically —as they will see that their efforts provide economic value to a place, and to their bottom line. As Porter and Kramer point out, “the competitiveness of a company and the health of the communities around it are closely intertwined. A business needs a successful community, not only to create demand for its products but also to provide critical public assets and a supportive environment. A community needs successful businesses to provide jobs and wealth creation opportunities for its citizens.”¹⁰³ One way for governments to help create a successful community supportive of corporations is to provide critical public assets, services, and accessibility, as well as to help build industry clusters in the communities where the company is located through supporting industry supportive activities and initiatives. Clearly as a company is stretched across multiple

¹⁰⁰ The Economist Editors “Free Exchange: Arrested Development: America and Europe are relying on private firms in the global R&D race” in *The Economist*, Aug 25th 2012, <http://www.economist.com/node/21560863>

¹⁰¹ The Economist Article, Ibid.

¹⁰² National Science Foundation, Ibid

¹⁰³ Michael Porter and Mark Kramer, “Creating Shared Value” in *Harvard Business Review* (Cambridge: Harvard Business Review, January 2011).

locations, it has to make many strategic choices of when and how it becomes involved in the local communities in which they are situated.

Currently, the lead anchors of these networked cities, major educational and research institutions and corporations, are often asked to play a dominant role in building a supportive environment for economic growth due to the city's and state's lack of other resources. All cities face municipal budget constraints, which often requires other local, able agents to take a greater role in economic development. However corporations, universities, and private contract services have other missions and institutional responsibilities such as to their stockholders and investors. Furthermore, corporations are increasingly distanced from their locational places, as they function often on a far wider national and global level, almost independently from communities in their physical locations; they are more closely connected to multiple cities through their satellite initiatives and distributed workforce. This leads to ad-hoc investment strategies in the places they inhabit, and their local community involvement often results from happenstance rather than a planned, thoughtful strategy.

Historically, from the start of the Industrial revolution to the beginning of the Information Age corporate/industrial sector anchored most cities—both in terms of the economy, the workforce, innovation activity, and community support mechanisms, which provided a quality of life in an area, workforce training, and even physical development. This period of corporate/industrial dominance in cities paralleled the industrial development economy. However, in gross terms and in most sectors that achieved corporate 'might', this markedly changed as the corporations scale increased, fueled by mergers and acquisitions in the late 20th century, and the development of the multi-locational and then multinational corporations. Over the past decades, the distance between corporate headquarters and their satellite workplaces grew, as the level of corporate engagement in localized economies diminished.

Corporations are shifting from global corporations to metanational corporations¹⁰⁴ that no longer simply have one headquarters and a host of satellite offices and manufacturing plants across the globe, nor are they only an assembly of mergers and acquisitions, but are emerging as sophisticated organization of unique cells that form an aggregated competitive corporate network. While becoming more sustainable and flexible structures, gleaning the best advantages of each place for the betterment of the whole, they are becoming less tied to particular places, fueled in part distributed decision-making and flattening organizational hierarchies. As we look at future economic development policy, the key question is how to better facilitate the growth of these metanational of companies, and provide access points to places that are consistent with their needs, and that benefit local economies. Current policy would place monetary and political friction between the many locations based on inherent competition by independent localized economic development initiatives, and therefore slowing the growth of the economy.

Like their corporate parents, corporate R&D organizations are increasingly distributed geographically, further impacting the ability for knowledge transfer to take root locally.

¹⁰⁴ Yves Dos, Jose Santos and Peter Williamson, *From Global to Metanational, How Companies Win in the Knowledge Economy* (Boston, Harvard Business School Publishing Corporation, 2001).

Originally R&D facilities were located near production facilities¹⁰⁵ to take advantage of physical proximity during the design and innovation process, which required frequent communication to understand the manufacturing process and hands-on tweaking along the way. With the expansion of companies regionally, nationally and globally, the lowering cost of transportation, and ability to consider the 'lowest cost' for production and 'knowledge work,' close proximity is no longer necessary. Many new R&D locations are near university talent, which is often located in a secondary market that may not have a 'mature industrial cluster.'

As detailed in many corporate websites and annual reports, and as outlined by Porter in his 'shared value' work, the corporate sector has typically interpreted its role in the 'community' through the 'corporate responsibility' lens: a commitment to the broader community through 'sustainability' initiatives, and in direct community involvement via employee community volunteer work, educational scholarships, support of school and university initiatives, support of community sports and civic initiatives, and other straightforward sponsorship practices. Of course, economic impact results from the variety of service jobs that spin off of new or increased activity, which is supportive but by no means does it accelerant the innovation economy. Politically these initiatives play well, especially when the corporation receives traditional economic development incentives (e.g., money to move to a particular location), but they may not 'move the needle' in terms of real 'ripple' effects; few of these 'corporate responsibility community-based initiatives promote economic activity in the local place. The following examples and analysis examine models of engagement that are novel, and also provide a level of productive economic activity in the corporation's place. These positive activities range from supporting a climate of innovation from such as local and international sponsorship of conventions/conferences, establishing accessible resources, and acquisition of resources that extend the corporation further into the community.

Internal Model of R&D

There are as many models of internal structure to corporate R&D as there are firms that are actively pursuing R&D, and seeking alternative models to accomplish critical innovation work. The way firms structure their internal organization to facilitate unique activity, and then evaluate and reward researchers, ultimate effects their productivity, and the personal ambitions (and potentially, the knowledge spillover) of the researchers. The geographical extension of personal and professional networks and corporate locational structures has had a ripple effect on places beyond firms' specific economic geographies. For instance, researchers in corporate environments may have a relationship with a university researcher, and mentor startups in a location that is not where that corporation is located.

Many internal mechanisms to spur innovation have been instrumental in developing an supportive culture within corporations, including micro-R&D incubation, sanctioned time to use on solo projects and a more structured technology transfer approach including seed funding for new ideas. For instance, the new media company Pixar gives employees a certain amount of official work time to pursue personal projects, which has resulted in innovations, because workers can 'follow their bliss' at least for a few hours each week. Another example is Google's 70/20/10 rule of time distribution whereby employees use 70 % of their time on official work assigned projects, and 10% of their time on individual projects, which has reportedly changed

¹⁰⁵ Andrew Rodrigo Nigrinis, Stanford University; Where Did Industrial R&D Labs Locate? The Inter War Years, Unpublished document.

as the company has grown more distributed. There are other models such as the IBM's Integrated Delivery Model & Company Jams (open brainstorming events on IBM's intranet around key topics), which has provided a corporate model for internal networking and building cross-disciplinary conversations that can lead to further innovation. Finally, within a more typically research-heavy industry like biotechnology, are many internal processes aimed to help scientists to produce and publish pure research for the organization. Finally, the classic approach to spurring both internal and external R&D activities has been for a corporation to raise 'intrapreneur venture funds.' A example is XTV, initiated as Xerox's strategic goal to develop technology internally, develop spin-offs externally, providing for financial return based on ownership stake, and for future acquisition if the technology; these have proven both successful and useful to the corporation. The examples below flesh out these various methods of catalyzing internal innovation using current and emerging models.

Microsoft, U.S. leader in corporate R&D at \$9 billion in 2011,¹⁰⁶ embraces a more 'academic' model, specifically in its most ambitious R&D units. Historically centered around the Redmond/Seattle area (the most 'elite' closer to the headquarters), its R&D activities are now distributed across the globe: approximately 850 researchers operate in 11 worldwide centers of research.¹⁰⁷

As discussed with Doug Burger,¹⁰⁸ Director of Microsoft's eXtreme Computing Group or XCG lab (the only division which does not have business line), which develops "new technologies and integrated, solution-based prototypes ... to accelerate change—in hardware, systems, platforms and applications."¹⁰⁹ Its labs typically engage in pure research, and researchers can work on whatever they want; some publish and participate in internal tech transfer activities and develop deep relationships with universities, including joint faculty appointments, others work with researchers on university-funded projects. Additionally, people are brought to campus regularly for conferences, and they have incubation features/labs that advance product development, including internal joint divisional incubators.

Historically located at Microsoft Corp. headquarters in Redmond, its R&D labs are now also located in strategic locations across the United States and abroad., often strategically close to talent pools and strong customer bases (e.g., Beijing, China). External research is considered a joint research lab approach (e.g., UC Berkeley and University of Illinois), which form 5-year 'institutes' in an effort to build multi-party academic and corporate partnership. An ecosystem has developed around the Bay Area and Redmond, Washington (Microsoft's home) worksites, but Microsoft has no formal startup investment arm. However, Microsoft is plugged into the ecosystem due to talent flows into and out of the company. They do not provide a venture capital role for startups, like Intel and Xerox but that's likely due to the fact that it's a lot of unnecessary work and they have the resources to buy companies when they want.

Microsoft, like many corporations, sponsors many major conferences both onsite and offsite of R&D facilities. These conventions can markedly affect the overall engagement of the corporation in a 'community,' but they generally operate at a more 'global' scale of

¹⁰⁶ The Economist, Ibid.

¹⁰⁷ Microsoft Research Data, <http://research.microsoft.com/en-us/about/default.aspx>

¹⁰⁸ Conversation with Doug Burger, Jan 28, 2013 (disclosure: author's cousin)

¹⁰⁹ About Microsoft Research Cambridge, <http://microsoftcambridge.com/About/tabid/60/Default.aspx>

engagement, and not the specific place (such as its effective pull of talent to Redmond). Certainly these activities may result in immediate economic impact (hotels/dinners), but they do not necessarily benefit the local economy in the medium-term, fostering more local business creation.

Accelerators & Innovation Labs: Talent Development & Venture Spinoff Activity

A leading example of more intense corporate engagement in an ecosystem, Microsoft created the New England Research & Development (NERD) Center to establish a concrete presence and corporate engagement in an established center of technology, in the heart of Cambridge, Mass., in Kendall Square, adjacent to MIT. NERD offers a broad spectrum of programs ranging from social networking, technology lectures, and a Women in Technology Program to open source projects and recruitment—activities very much interrelated in today’s business development operations.¹²⁰ The NERD Center is very visible, and an anchor in the local ecosystem, sponsoring events and providing support for program initiatives like Citizen Schools, which provide leadership training for low-income middle schoolers, and show support for the broader community, at least primarily for the tech community. Microsoft has further established such NERD centers in New York City, where it picked up a talent pool of a closing Yahoo R&D lab.

With a similar goal of gaining visible in a community (although strictly an engineering and innovation community) and among entrepreneurs, Sikorsky Aircraft¹²¹, which designs, manufactures and services military and commercial helicopters, based in Stratford, Conn., established a new unit outside its core business unit called ‘Sikorsky Innovations’. This mission of this 100-person group of employees and helicopter industry representatives is to “develop... technologies, products and processes that will redefine the future of vertical flight”¹²²; they are tasked with being both visible external agents of the corporation, and the facilitators in order to in-board new technology into the company. The innovation lab provides a ‘front door’ for potential talent/young companies to access their talent (within a different industry that is more historically ‘guarded’). Many other corporations have been establishing ‘innovation labs’ that run the gamut from pure skunkworks activities internal to the corporation to wholly separate agencies that extend technologically driven lines of communication to external researchers and companies.¹²³

As opposed to just attracting a ‘talent pool’ as a corporation’s impetus to engage more directly in a local community, other non-monetary incentives/ currencies also might lure a company to a location. In the example of IBM Dublin, a research center dedicated to ‘Smart Cities’ was located in a the local municipality which was directly involved in the attraction of the facility. IBM was very interested in working from ‘real municipal data’ from various city departments, and the City of Dublin provided open access to this information—very valuable to IBM to develop new technologies and services. Similarly, government initiatives such as ‘NYC BigApps,’ originally launched in 2009, have provided a rich platform for many companies (existing and startup) to investigate new technologies based on this open data from the city. “Over the past three years of competitions, 238 eligible applications utilizing city data have

¹²⁰ About Microsoft Research Cambridge, <http://microsoftcambridge.com/About/tabid/60/Default.aspx>

¹²¹ Subsidiary of United Technologies Corporation, Global headquarters, Connecticut,

¹²² Sikorsky Innovations’ web page: <http://www.sikorsky.com/Innovation>

¹²³ Conversation with Bonnie Shaw, Ongoing Research, 3.7.13

been created for New Yorkers, of which approximately 30 were selected winners, earning a total of \$110,000 in prizes.¹¹⁴ This act of opening data has a marked effect of spurring business development in the city, through the creation or growth of new firms, but larger corporations like IBM can muster more global resources, and will be considering how to apply this knowledge and technology development to a broader set of applications.

Facebook's recent efforts to 'meet and greet' and provide training programs for nascent talent pools prompted the firm to develop disparate 'hubs,' across the globe. They are sending representatives to New York, London, and Seoul, and providing a chance for face-to-face exchanges with talent pools and other nascent companies that might be working with their platform: "We wanted to have the opportunity to come out and meet those developers, and talk about some of our experiences and talk about how Facebook can help those developers become successful."¹¹⁵ These events aim to stimulate the creation of regional startups that will further provide opportunities for networking and potential Yahoo collaborations. These 'meet and greet' initiatives are less 'tangible' than innovation labs, and more like 'pop up' workshops, but require less physical infrastructure and management of a physical laboratory, yet inspire new venture creations.

Evernote just launched the Evernote Accelerator, where potential startups who are developing functions that would integrate with the Evernote platform can spend a paid month with the senior developers at Evernote, on site. Like a traditional accelerator, the teams have access to expertise, mentors, and future investors/journalists and other resources. Although these companies would not be part of Evernote, and Evernote would not take an ownership stake in the product either. These companies would go through a rigorous screening process (DevCup) and be matched with an external sponsor that would pay for their transport and lodging during their time at the accelerator. This particular method marries 'innovation lab' philosophy with a traditional accelerator, and further expands the organizational reach of Evernote R&D external to its official corporate boundaries. These relationships made in the accelerator are sure to have a longer-term benefit to both corporations, and Evernote is supportive to a broader business development impact.

Innovation Exchanges Expand Geography and Disrupt Traditional R&D Spinoff Potential

One of the more striking developments in corporate R&D initiatives is an 'Open Innovation Network' model (initiated by progressive corporate R&D champions) and the emergence of new 'intermediating' organizations. These projects have established a better means of external connection in order to improve connections between the corporation (traditional R&D efforts), researchers, and small companies.

Looking more specifically at models that are now proliferating within the corporate sector, Proctor & Gamble established the Connect & Develop¹¹⁶ program in 2002 to examine ways that large corporations, with large Innovation R&D budgets, can facilitate faster processes to hasten

¹¹⁴ NYC Big Apps Information, <http://nycbigapps.com/static/about>

¹¹⁵ Samantha Murphy, "Facebook Mobile Developer Conference Coming to 3 Global Cities," on Mashable.com, 12 March 2013, <http://mashable.com/2013/03/12/facebook-mobile-devcon-2013/>

¹¹⁶ any relationship between program title, and title of this thesis is accidental—the thesis title which is about economic development for networked cities emerged prior to the author having read the HBR article as quoted.

the pace of getting products to market.¹¹⁷ Through professional networks, and a tech brief 'need' they are able to source new technology very quickly. Upon the first success, the head of innovation realized that instead of reinforcing and reorganizing internal channels, the innovation was "increasingly being done at small and mid-size entrepreneurial companies" and that universities and government agencies were very interested in 'partnering' with industry. Even internally they had found that the most innovative ideas had come from bridging across standard divisions, incorporating expertise from multiple product lines. They decided to leverage internal talent and extend their network of innovation outside the firm's boundaries'.

According to 2006 industry reports and business cases,, more than 35% of new products emerged from outside of P&G, and 45% of its product portfolio have components discovered externally. In February 2013 P&G launched a new website for the open innovation process—after 10 years of operating, the program has resulted in over 2,000 active partnerships developed through the Connect & Develop program.¹¹⁸ The authors very clearly pointed out that this was not just 'outsourcing' R&D or about acquisition, but about finding and exchanging ideas, and engaging them to 'enhance and capitalize' on internal capabilities. The key catalyst in this case is the exchange of knowledge and expertise that simultaneously grows both external and internal capacity and productivity, along with the company's functional geography.

Top-Coder, another firm aiming to promote innovation, is a software product development platform, and a geographically distributed organization. The core business was founded, and is based, in Connecticut and relies on a workforce of developers working on behalf of clients in a prize-based competition model. Top-Coder takes the concept of open innovation to the services industry. Ultimately, a working organizational cell of Top Coder is in every state and all over the globe, operating as an independent company, and Top Coder does not see specific job growth in the home area. This extended network has enabled the company to be where it wants to be, limit expenses and overhead, and instead of coaxing talent to move to them, the organization has virtually moved to the talent.¹¹⁹

Finally, Quirky, a web-based, crowd-sourced, product development service, where anyone can submit a patent idea upon which thousands of users vote, recently established a novel partnership with General Electric to repurpose and provide significant corporate IP to independent developers located across the country.¹²⁰ In fact, about 50% of Quirky's developers are located across the country, including but not exclusive to large 'recognized'

¹¹⁷ Larry Huston and Nabil Sakkab, "Connect and Develop: Inside Proctor & Gamble's New Model for Innovation" in Harvard Business Review (March 2006)

¹¹⁸ <http://www.marketwatch.com/story/pg-connectdevelop-launches-new-open-innovation-website-2013-02-07>

¹¹⁹ Conversation with Jack Hughes, CEO Top Coder, 4.21.13

¹²⁰ Adam Ludwig and Adrienne Burke, "GE-Quirky Deal Opens Patents to Almost Anyone," on Techonomy.com, 10 April 2013, <http://techonomy.com/2013/04/ge-quirky-deal-opens-tech-patents-to-almost-everybody> "Announcing the partnership at Quirky's Chelsea headquarters, 26-year-old founder Ben Kaufman said it would "return patents to their original purpose to act as a blueprint for technological and societal progress, while protecting inventors and becoming a source of inspiration for future creators."

innovation cities. “What makes a site like Quirky interesting is that everyone gets a shot.”¹²¹ These types of exchanges, if successful at advancing knowledge transfer, can propel company formation more broadly, rather than be limited to the IP location or company headquarters. Similarly, as Quirky (headquartered in NYC with additional office locations worldwide including China) works on improving local sourcing for product prototyping and manufacture. Over time, Quirky will demonstrate a more dispersed, but impactful map of economic activity, and not exclusive to the ‘established’ innovation centers—sources can be found as the crowd based platform allows for more visibility from many places.

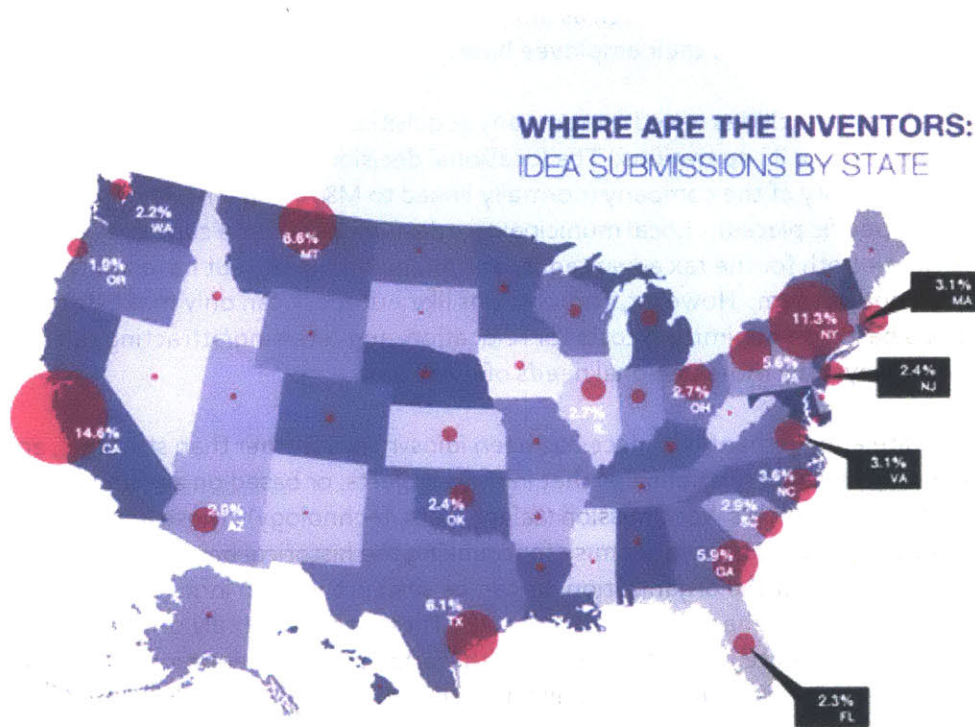


Figure 11: Map showing where inventions are coming from that are proposed to Quirky. Inventors do not necessarily live where production happens, or in established innovation hubs, but rather dispersed.¹²²

Experimentation-New Models for Catalyzing Innovation

A unique model, and an unintentional (i.e. not strategic plan) one at that, is emerging that provides knowledge learning and transfer at a more granular level. The model involves investing in small service or shared asset facilities in order to provide links between technology development and users. Instead of using direct capital for external activities, this type of investment uses part of a balance sheet (investments) that shareholders would approve, while still help the ecosystem. This type of expansion can further expand an organization’s boundaries.

¹²¹ Cliff Kuang, “Infographic of the Day: How Does Innovation Flow From Cities” on FastCo Design Blog, <http://www.fastcodesign.com/1664973/infographic-of-the-day-does-innovation-flow-from-cities>

¹²² Cliff Kuang, Ibid

Autodesk, a corporate leader in digital drafting technology for the engineering/construction and manufacturing industries, has purchased a major share in a company, TechShop, a San Francisco-originated shared-asset workshop/fabrication shop model that has grown rapidly in parallel with the emerging nationwide 'makers movement'.¹²³ This investment was motivated by leadership's specific interests, but has the added benefit of giving the larger corporation a first-hand view of how their technology can be utilized at a very granular user level for both new product development and user interest trending. Given the overall budget of the corporation, this was a minor investment so it did not significantly trigger strategic investment issues.¹²⁴ Otherwise, in terms of engagement of the ecosystem, historically Autodesk has followed a common pattern of tech companies such as internships, and unique opportunities, "fun projects attract talent," in order to build their employee base.

Autodesk, has located facilities based on company acquisitions, and/or close proximity to critical talent needed for its operations. The locational decisions are both strategic, and part of the evolutionary history of the company (normally linked to M&A, and inheriting parts of corporations in specific places). Local municipalities desperately want a corporate presence and engagement—both for the tax advantages, and 'bragging rights', but have limited means to attract and engage them. However, corporations like Autodesk can only make decisions about locations based on minimizing costs for relocation, and retaining/attracting talent, but are sometimes swayed by more personal needs of leadership.

Overall, corporate engagement in a place has been idiosyncratic rather than strategic, and is often triggered by personal relationships that initiate projects, or based on a resource need to further extend a corporation's work/mission (talent, data, technology). These and additional models of corporate evolution hold promise for breaking the historical barriers to knowledge transfer out of the walls of the organization, as can be seen in the open innovation network developments and applied shared asset 'demo' sites. These models, purely driven by the corporate need to accelerate innovation, along with learning, experimentation, and growth could help to catalyze such activity at a localized level.

University R&D—Accelerating Localized Benefit by Recognizing Mobility and Connectedness by Learning from Industry:

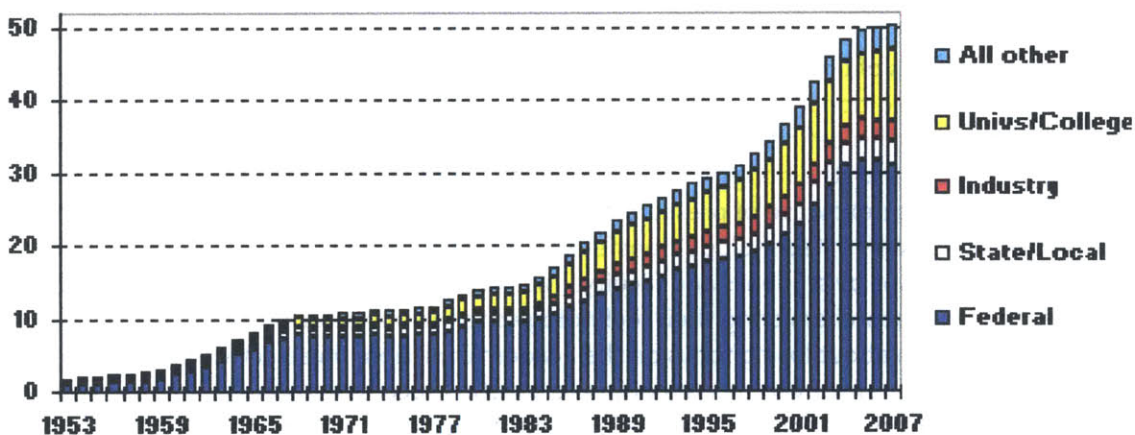
Often the root of R&D activity is the pure research that emanates from universities. Research in these universities is funded by a variety of sources from government (e.g., for biotech, the National Institute for Health), the corporate sector (e.g., electronics firms), and not-for-profit foundations (e.g. special interest/advocacy foundations focused on curing diseases). Additionally, these organizations have a variety of initiatives both on campus and externally that stimulate additional entrepreneurial activity. These entities are also efficient 'conveners' and facilitate knowledge transfer activities within the university-corporation-government 'triple helix.' Generally intended to support their academic population, these events additionally support many other regional and national groups of individuals, from professionals to middle school students (e.g., via science fairs and summer camps).

¹²³ a word about maker's movement here—interface of handwork, small craft, hobby, and new technologies.

¹²⁴ Conversation with Phil Bernstein, Chief of Strategy for Industry Solutions, 1.18.13

Universities perform 53% of overall pure research in the United States, and performed about \$54 B in 2009 that is about 14% of total spending on R&D, and this investment has been growing over time. Although Universities rely on federal grants, they are a significant receiver of Corporate R&D spend/support as well.¹²⁵ Through various technology transfer programs, discussed below in this document, these activities at Universities have been noted as key influencers of local economic development.

R&D at Colleges and Universities by Source of Funds in billions of constant FY 2008 dollars, FY 1953-2007



Source: National Science Foundation, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 2007, 2008. Constant-dollar conversions based on OMB's GDP deflator. AUGUST '08 © 2008 AAAS



Figure 12: Historical funding sources at Universities and Colleges for R&D, per analysis by the organization American Association of Advancing Science.¹²⁶

More directly than most corporations (especially the multi-locational ones), the American university is historically rooted in a particular place, and thereby has the most to gain by its involvement in local economic development. However, the role of the university within a community and within the local and broader economy has been in transition, and some say we are at a truly watershed moment.¹²⁷ The last 20 years has seen remarkable expansion of the university's role in the community in an effort to stabilize and transform a surrounding community into a desirable environment that will attract.

¹²⁵ US National Science Foundation, Ibid

¹²⁶ American Association of Advancing Science, "Programs: Science and Policy, Guide to R&D Funding: R&D at Colleges and Universities" on AAAS website (August 2008). <http://www.aaas.org/spp/rd/> (Science 2008)

¹²⁷ Clayton Christensen Lecture 3/6, The Disruption of the University Education System.

As the competitive landscape has increased for universities to attract the best talent in terms of faculty and students, so as to garner as many research dollars as possible, development investments have become a key initiative of universities—improving both their knowledge base (e.g., professors, students and research output), capital plants and neighborhoods. What is most important, as universities reconsider their connection to industry, and the potential for knowledge spillover, they realize that they need to build greater connectivity to industry to truly help economic development. As Feldman notes, “a greater potential for knowledge spillover exists when firms involved in R&D projects have multiple supportive connections to other for-profit enterprises ... [and] the more linkages that a firm has with universities, the greater the potential for knowledge spillovers.”¹²⁸ Knowledge spillovers include a range of actions from technology licenses to serendipitous encounters between researchers, companies, students, and entrepreneurs.

The increased efforts of universities over the last few decades has certainly changed the definition of their traditional pure academic mission. Termed the ‘second academic revolution’ by Henry Ektowitz in his definition of the *Entrepreneurial University*, universities have taken on roles much broader than their original ‘teaching’ role, to include research, and economic development.¹²⁹ The next wave of pressure on the original mission has been the conversation about universities’ roles in technology transfer and the commercialization of technology developed in their labs by students and faculty. Many universities have had programs and resources to help researchers bring their technologies to the market. However, given the institutional concern about losing focus on the academic mission, these activities typically remained sotto voce. However, recent commercialization success evolving from collegiate labs that led to financial reward for some Universities has fueled institutional interest in this over the past 20 years.¹³⁰

It is estimated that at least 75% of people who work in an institution spin off companies in that local area,¹³¹ creating even more of an interest in local economic development activities. Additionally, sponsoring university entrepreneurship activities has been a significant way that universities integrate the external ‘ecosystem’ (e.g., the local community) within their activities. The building of relationships between financial sources, mentors in industry, and support services have resulted in more productive, meaningful and longer lasting relationships than those historically brokered by university technology transfer offices (TTO).

Institutional Brand Magnet for Corporations & Research Institutes

University institutions, specifically their research activities, have always been a brand magnet

¹²⁸ Feldman and Kelley, *Research Policy*, 1510

¹²⁹ Henry Etkowitz: “Research Groups as Quasi-Firms : the Invention of the Entrepreneurial University in *Research Policy*,” Vol 32, Issue 1 (2001)

¹³⁰ As an indication of the changing role of the University as an economic development engine, the growth of University Satellites increasingly new programs/positions for University administration include the title/role of Economic Development (greater role than just community relations). Almost daily on a ‘google alert’ for ‘university technology transfer’ or job posting for ‘economic development, there is a listing for a senior University position that includes Research and Economic Development in the title.

¹³¹ Joshua B Powers, “R&D Funding Sources and University Tech Transfer: What is stimulating Universities to be More Entrepreneurial ” in *Research in Higher Education* Vol 45 No 1 (2004).

for industry interest. Microsoft, IBM, and Autodesk, mentioned above, have had significant ties to universities over the years that have resulted in numerous joint activities ranging from joint appointments (corporate researchers and university professorships) to scholarships and funding for university researchers. Benefits also emerge when collaborating scientists at universities and corporations jointly publish papers. Additionally, according to a few tech startup advisors consulted for this project, startup ventures like to recruit partners and associates from academia as it not only adds inherent value in terms of their knowledge and networks but it also adds prestige; if a venture can list its associates' affiliations with noteworthy universities such as Stanford, Yale, Harvard, and MIT, the firm's perceived value increases from the perspective of potential investors and clients. Some analysts have speculated that industry may be more interested in the access to university talent more than the actual university technologies.¹³² These university-industry collaborations have served to extend both entities' geographic network far beyond locational boundaries.

Perhaps as a result of universities' desire to secure diverse funding streams and increase their relevance and reach, a new trend has emerged whereby 'research institutes' (often spinoffs of universities) are bringing together university, government and industry representatives in a highly coordinated and integrated way, with significant efforts focused on building core competencies that benefit all players, including local governments (e.g., economic development agencies). For example, the State University of New York at Albany recently launched the College for Nanoscale Science and Engineering (CNSE) by leveraging university, corporate and government resources for this college aimed to promote "accelerated high technology education and commercialization," to provide "global education, research, development and technology deployment" and "to create jobs and economic growth for nanotechnology-related industries."¹³³

The state of New York invested in creating this research institute to build out an emerging branch of research. With the 'local' industrial partner of IBM, they were able to build a true 'Fab' facility for fabricating semiconductor chips whereby students can learn while they work within real-life industry facility with experienced researchers building prototypes to be used at IBM and other partners engaged in joint research and testing. Since this investment, it has created new networks with industries and other universities, and more importantly set up localized operations in Albany that draw talent from inside and outside the region and supports local businesses and government agencies.

Research centers at universities naturally bring in researchers and industry representatives from beyond their regions. According to Richard Florida, along the experience of CMU in Pittsburgh, the role of most joint research centers derive from universities' response to government grant incentives¹³⁴ (e.g., E.D.A. Regional Innovation Cluster Initiatives), and not industry. As discussed above, many federal and private foundation grants require university-industry collaborations in order to better strengthen local ties, leverage additional private resources, and encourage knowledge spillover to build healthy clusters.

¹³² Many Sources

¹³³ <http://cnse.albany.edu/AboutUs.aspx>

¹³⁴ The College of Nanoscale Science and Engineering home page, <http://cnse.albany.edu/AboutUs.aspx>

As Richard Florida, a scholar on the knowledge economy as a driver for urban success, has noted that the university plays a key role in a city, but is not the 'factor' in regional economic development, but the supportive structure.¹³⁵ However, especially in smaller cities, where the role of universities is significant, universities must take on at least a partial role in produce fuel for that economic growth. Increasingly, universities have seen their role as a participant in local economic development as an important part of their mission although there is no common framework for that relationship. As Powers had noted, perhaps the best driver for economic development is the intellectual talent that universities alone can attract.¹³⁶

Internal Centers of Entrepreneurship: Cultural Shifts

The growth of university-sponsored entrepreneurship programs and partnerships has blossomed in the last few years—signifying a trend that could be attributed to many factors such as the lack of jobs for current graduates, the popular press romance with entrepreneurial opportunity, and the perceived accessibility, promise and speed of web technology. These efforts grow from both interested students and faculty as well as primary research activities, and range from single courses and student clubs to established entrepreneurial resource centers with significant private funding or networks to access it. MIT has remained the gold standard of the university's role in producing entrepreneur-led ventures. Edward Roberts, MIT Management of Technology professor and Founder of the MIT Trust Center, which provides the MIT community with programs and facilities to transform ideas into business ventures, noted that MIT alumni have founded an estimated 25,600 companies that employ about 3.3 million people worldwide, and generate \$2 trillion in annual revenues.¹³⁷ This scale of effort goes far beyond economic development in Cambridge, Massachusetts. While a great deal of these ventures remain in the area, many move beyond the region and the continent. Suffice it to say, the local 'entrepreneurial pipeline' is healthy, with an annual rate of formal spinoffs to be 25,¹³⁸ and the new ventures created formally not quantified, but likely more than 50 that are created during the MIT 100K Business Plan Competition. Most other universities trail in comparison, but the localized resources continue to grow in a desire to build critical mass of activity to match both growing student demand for such opportunities and to mirror the success of major research institutions.

In comparison to MIT, Yale's efforts have been small but impactful given Yale Entrepreneurial Institute's (YEI's) 7 years of existence. YEI has helped start nearly 100 companies, 52 of which are still operating. It is estimated that nearly 1/3 are located in New Haven, which may have more to do with the age of the co-founders (primarily undergraduate, ambitious, worldly) than it has to do with New Haven itself. The key factor in terms of 'stickiness' to a place is available talent, the critical mass of overall activity (in some cases industry specific), and the influence of venture capital (regarding location). However, different entrepreneurs at different life stages will choose to remain in a supportive area for quality of life issues, and others who leave continue to connect to the resources remotely and through increased travel. Sometimes these ventures choose to locate in multiple places to take advantage of resources specific to different

¹³⁵ Richard Florida, *Issues in Science and Technology*, 366

¹³⁶ Powers, *Research in Higher Education*

¹³⁷ MIT Press Release, November 2011, <http://web.mit.edu/press/2011/trust-center-dedicated.html>

¹³⁸ Edward Roberts Charles Easley, *Entrepreneurial Impact: The Role of MIT*, Kaufman Foundation Report, 2009, p 4

places. Especially in the very critical growth stages of the 'valley of death'¹³⁹, companies need to for resources that may exist beyond their regions. Hadapt, emerged from the Yale Computer Science Program and School of Management, but one cofounder relocated to Cambridge to find the specific technologist needed for their platform (one moves for many more than one reason). PaperG, a digital media-advertising platform moved from New Haven? to Seattle specifically to take advantage of Microsoft talent. These are examples of undergraduate, and/or young graduate school students who were unattached (free from family commitments), and wanting to relocate closer to home, to previous education location ties, and/or a new location.

Smaller cities with universities like New Haven (Yale) have historically both trumpeted the success of companies moving away "to the big leagues" while also 'mourning' the loss of a local company that could have helped build critical mass. In New Haven an often unspoken tension exists between a companies started by Yale alumni, and those independent of Yale ties. However, Yale-alumni founded firms, would often have co-founders (friends met at networking functions/incubators) who were not Yale affiliated and thus could not access Yale-exclusive facilities (e.g., the gym, the campus libraries), thus affecting the quality of life for non-Yale affiliates. Even alumni sometimes have difficulty accessing programs/resources of universities, creating even more of a challenge for those young companies who chose to remain in New Haven.

Distributed R&D Impact of Universities

Primarily, the distributed research 'map' has promoted collaboration within the scientific community. Cross-institutional collaboration has increased in the past few decades due to various factors: an increase in industry collaborations, and increase in digital connectivity of research, and national/international conferences that promote partnering and collaborations. As shown in the diagram below, a visualization of scientific papers published (and their authors' locations) from a dataset of published papers (from Elsevier, noted scientific paper publisher); the geography of these collaborations 'physically' connect many disparate cities, and these collaborations facilitate an additional dimension of knowledge sharing and knowledge spillover. Certain sectors tend to publish more frequently as 'coauthors,' such as biology and biomedical innovation.¹⁴⁰ However, this trend continues in line with other more fundamental societal shifts to 'open' activities. The byproduct of such collaboration inevitably creates additional networking and publishing opportunities, and potentially more economic development.

¹³⁹ The term *Valley of Death*, also called *Death Valley Curve* relates to the period between funding and negative cash flow in a startup's early years, when many startups fail.

¹⁴⁰ M.E.J. Newman, "Coauthorship networks and patterns of scientific collaboration", Proceedings of the National Academy of Sciences (USA 2004)

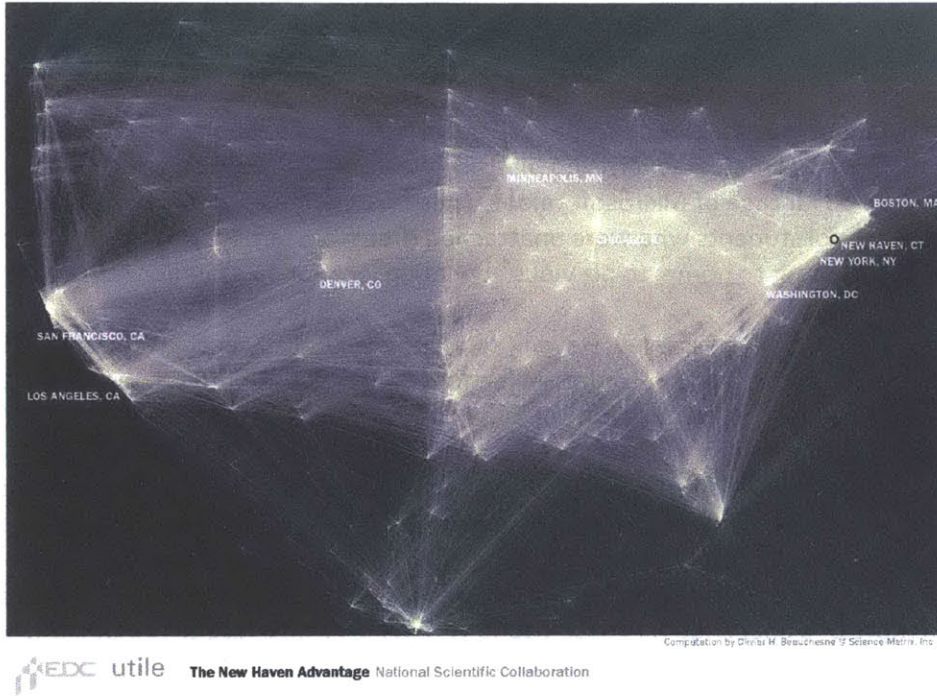


Figure 13: This map, an original inspiration for this study, documents the ties between collaborators on scientific papers as a visualization of the innovation economy. Illustration: Beauchesne, Olivier H. , Collaborative Cybernetics¹⁴¹

The institutions, universities and other research institutes, on the other hand, have a broad diaspora, and increasing satellite initiatives of their own. Their researchers, who are the largest contributors to R&D in local economies, are often collaborating with other researchers in distributed locations. Additionally, alumni who start companies play a role as they may draw on resources and networks from their previous university experience, and may be willing to contribute (give back) to the institutional mission, further linking the activities of universities to the broader world. The role of the institutionally linked community (or 'diaspora') in entrepreneurship has been more widely documented along ethnic or national lines, but the university diaspora could network and create more robust business development—they are a natural network of people who share common ties.

Technology Transfer Activities that Promote Economic Development

Finally, the role of university technology transfer programs should be examined as it relates to both localized business venture creation, and its mission within universities. Especially given recent patent law changes (e.g., America Invents Act], which will affect university licensing offices directly, it is important to review both resources and best practices to evaluate where efforts are most impactful and who should capture and assess the value of this effort. As described by Maryann Feldman and Gil Avnimelech in a conference presentation, "Impact of Institution Quality, Cluster Strength and TLO Licensing", "the effectiveness of the university's licensing activity has a negative impact on spawning and royalties/equity share policy has a

¹⁴¹ <http://olihb.com/2011/01/23/map-of-scientific-collaboration-between-researchers/>

positive impact on spawning ... moreover the institutions must understand the tradeoff between licensing activity and spin-off activity."¹⁴²

In a recent Brookings Institute study on the overall effect of technology transfer activities, concluded that better business models for technology licensing offices (TLOs) will promote better results and accelerate innovation to benefit the overall economy.¹⁴³ For instance, a streamlined, universal reporting system and greater transparency could help spur activity and educate the public on value the TLO process, helping create further support for commercialization. Metrics to evaluate TLOs should be broad and focus on outcomes, and the accomplishment of a variety of relevant goals—not simply based on the number of patents filed or dollars made. Additionally, the Brookings Institute suggests that the visibility and transparency of investments will bring in more investments to spinoff technologies, and that TLOs currently think short term instead of long term, due to the nature of their evaluation pressures, but in direct conflict with the fact that many ventures take time to mature. The Brookings Institute report was based, in part, on the annual report from the Association of University Technology Managers in which 60% of respondents reported that they regard economic development as critical part of their role, but only 8% of overall staff time was devoted to it.¹⁴⁴

At the level of the smaller city, the Yale Office of Cooperative Research (OCR) is an example of a more traditional research university licensing office with a blurry and evolving mission, is it part of an academic institution designed to support researchers, or an organization supposed to spur localized economic development? Additionally, this institution, while productive, has a strong responsibility to further bridge historically silo academic departments. After years of focusing on departments where the primary research was being funded, and where the majority of technological spin off advancement was happening, biotech, the organization is in transition to find alternate ways to commercialize work in other parts of universities, sometimes requiring new expertise and personal relationships across universities and industry. Although the entity of Yale OCR maintains an 'outcomes focus,' which involves assessing specific metrics of patent production, licenses, and jobs created, the program also promotes a wide range of short-term activities including supports that provide appropriate environmental conditions for knowledge transfer and networking. The Yale OCR reports to the Provost (an academic post) but also is responsible to the institutional leadership that includes the investments mission, and to a lesser degree, the economic development mission¹⁴⁵. Like companies, however, these technology offices in smaller cities /are subject to their ability to attract talent, and tend to have less experience (and less competition) than some other institutions. Despite the inexperience, administrations and governments are putting further pressure on these institutions to promote 'entrepreneurship' and increased technology transfer.¹⁴⁶

¹⁴² Gil Avinmelech and Maryann P Feldman, "The Impact of Institution Quality, Cluster Strength and TLO Licensing Capacity on the Rate of Academic Staff Spin-Offs", Atlanta Conference on Science and Innovation Policy, (2011)

¹⁴³ West, Improving University Technology Transfer and Commercialization,

¹⁴⁴ AUTM Transaction Survey FY 2009, 25

¹⁴⁵ Professional Experience and Interview with John W. Puziss, Ph.D. Director of Technology Licensing, Office of Cooperative Research, Yale University School of Medicine, 2.22.13

¹⁴⁶ A Google alert for 'university technology transfer', alerting the author to whenever an article is produced that references the term, the author has received nearly daily emails that have identified

At the MIT end of the innovation spectrum is a factory of production and a culture (and history) that understands the process and necessity of commercialization and patent protection. As exemplified by the success (academic and commercial) of some of the major scientists, and research labs, the culture embraces the full 'knowledge chain,' and has a robust pipeline that further fuels the internal University 'economies' of activity. MIT TLO, ILP, Martin Trust for Entrepreneurship are the main entities that are structural architecture to the local ecosystem in Cambridge, but a number of other institutional 'engines' such as entrepreneurial courses, alumni forums, and local networks are producing the fuel to the activity as well. Given the wealth of individuals, institutes, and organizations that support entrepreneurship, there is a dizzying array of activities that envelop and catalyze individuals on campus and environs—it's a mature institutional, but dynamic individual hub. The richness comes from the diversity, density, and influx/outflux of rotating student bodies as well as people from external regions coming to connect.

Although universities consider themselves to be unique creators of pure research, and they are increasingly acknowledging this role in supporting localized economic development, should the role of technology transfer (or execution) be externalized to further connect to appropriate resources, potential collaborators, and manage the ever increasing complex network of multi-geographical relationships. Richard Florida has often remarked on the critical issues of where innovation lies? He has posited that Universities have taken on an overstated role with regard to commercialization.¹⁴⁷ Maybe in certain cases, where the institution is designed for the technology transfer (MIT) this makes sense, but every University does not need to develop such processes and redundancies. This way, universities can focus on core assets (knowledge producers/demographics, supporting and opening resources, enabling connecting to other students/universities and diaspora).

Government & Private R&D: Adjusting the Model from Institutional Spinoff to Integrated Resource:

The least visible R&D economic driver is private R&D contract institutions, which are often university lab spinoffs and/or government laboratories that do contract work for private industry (e.g., Battelle, Draper Labs]. These institutions generally have significant resources in terms of facilities, technology, talent, patents, funding, and /learning/knowledge?/, but have little interface with the local economies. Unlike universities, these R&D contractors have been able to remain more 'hidden' from the responsibility of engaging in the economic ecosystem of their places—as institutions of pure research without contributing products/services to the local market, they are more similar to academic institutions. In the R&D socio-economic hierarchy, these labs tend to be considered purely contract-based services, not entrepreneurial or innovation engines, and scientists and researchers do not consider them to be top-tier research institutes.

Despite their 'institutional permanence,' these institutions have great potential to be the major forces of technological development as they have a wealth of resources, and experience.

'new' tech transfer offices frequently. Many of these schools appear much smaller, and less resourced with research dollars than the primary institutions.

¹⁴⁷ Florida, *Issues in Science and Technology*

Similar to some of the economic endogenous shocks (e.g., required government downsizing) as mentioned above that spurred additional business creation (out of necessity), these government and contract R&D labs/ institutions are experiencing a prolonged pressure as reductions government funding for research has prompted these labs to reconsider their business strategies, as discussed in this section.

Foremost, the private R&D eco-structure that we see today was created by a national need for research and development beginning in the early 20th century. The government initiated massive efforts to decentralize and incentivize industries to partner with university researchers and to outsource some government lab work to the universities. Today, these labs are generally structured as independent not for profit organizations, or government owned labs that are affiliated with a federal entity such as the Department of Defense or the FDA; others are joint-agency efforts operated by for-profit contracting service companies. The Bayh-Dole Act enabled these institutions to participate in government research technology transfer benefits similar to those of universities.

Due to the typically high security nature of their client relationships, and the required confidentiality, the organizations are culturally cloaked, and except for departments that fill particular external roles such as community relations or sales and marketing, and even they have an introverted culture. These institution's original roles may have been more 'client relationship' focused, with little externalized activities, but in recent years have grown to support efforts to further business development activities (i.e., to expand the client base), attract talent, and to support of external partnerships and commercialization. This lack of engagement with outside parties further complicates their efforts to find appropriate external application of their technology, leaving the process to internal agents with their established industry networks.

Given government funding constriction in the last few years, both in terms of real dollars in contracts, and the contract procurement process, many of these labs have been forced to reevaluate their business strategy as their traditional funding channels have shrunk. In terms of a strategic refocus, some organizations have been more flexible, imaginative and better equipped than others. Those that diversified earlier into other modes of business, such as Battelle, which incorporated a services side of the business running some government laboratories, have been both more stable and more networked than their counterparts. Historically as they have had less need for linkages to institutions outside the government, these laboratories are challenged as they look to expand their efforts.

Each organization seems to have developed their own internal mechanisms for developing technology transfer activities, and more importantly, knowledge transfer within the organizations. The effectiveness of internal technology transfer has been varied, as their output seems lower than their capacity (given the resources and ground-breaking work involved).

Classical Structure of Contract R&D and Satellites

Draper Lab was originally an MIT research lab tasked with assisting the U.S. Dept. of Defense and other government agencies in developing technologies on a contract basis. Draper spun out from MIT to form a not-for-profit R&D organization in 1973. Today it boasts 1,500 employees in with multiple locations, although the majority of are located in Cambridge and in the Boston area. Its current mission, "To serve the national interest in applied research,

engineering development, education, and technology transfer,” and carries out R&D in security, space exploration, healthcare, and energy.¹⁴⁸

Aside from partnering and locating particular lab activities in locations where partnerships have been established, Draper has traditionally sponsored research fellowships, including the “Draper Prize” to recognize innovation in engineering, along with other community educational programs. However, more recently, Draper has been a lead convener in multidisciplinary partnerships, often spurred by an endogenous event (e.g., a local military base closing), but has expanded as it realized the benefits of external relationships. Draper participates in the Natick Science & Technology Board includes members from Rhode Island and Connecticut—a defense tech initiative that grew out of conversations regarding U.S. Army/Air Force base closures and related government labs. Natick worked on engineering unique food and clothing solutions for the military, and Draper helped them shift to a more 'systems' approach to providing both elements due to changes in the soldier's role. Additionally, Draper Labs founded the Center for Soldier Innovation/Soldier Performance and the Advanced Cyber Security Center with RSA (EMC) BBN (Raytheon), Northeastern, and Harvard's Kennedy School of Government. Initiated with some initial seed funding, Draper is currently securing more support to advance the initiative.

Internally, Draper is developing technology and knowledge transfer initiatives to examine new opportunities to grow and spinoff, and license technology. It has some internal seed funding for these ventures, and has even 'mini crowd sourced' to find related smaller technologies to serve technology needs. Currently, although individuals from across the organization are involved in technology transfer efforts (from business development to legal counsel) only a 'task force' is exploring forward thinking initiatives, and no formal division is responsible for this task force nor are funds allocated for this role.

Increased Service Portfolio & Venture Funds

Battelle (Battelle Memorial Institute) is one of the better known and most geographically dispersed private nonprofit R&D organizations, headquartered in Columbus, Ohio, boasts 100 sites across the country, and 20,000 employees.¹⁴⁹ Founded in 1930 by a visionary Gordon Battelle, it began as a R&D lab concentrated on metals and material science. Its mission today : “Committed to science and technology for the greater good”¹⁵⁰ Originally, and still at its core, Battelle is a contract research institution, and focuses on emerging areas of science, develops and commercializes technology, manages laboratories and does service work for clients. More recently it has begun consulting with private labs, and large think-tanks on technology transfer strategy, and best practices.

Its primary business model is management contracts (turnkey lab operations) and has a fee-based service arrangement. Lab managers are Battelle employees, and the local labs are independent, but can access the expertise of Battelle central. It also has direct contract R&D with government agencies and industry, and for universities including nearby Ohio State. Often Battelle serves as a key manager of a joint venture for certain lab management contracts.

¹⁴⁸ <http://www.draper.com/profile.html>

¹⁴⁹ (College of Nanoscale Science and Engineering-Albany n.d.)(Draper Laboratory 2013)

¹⁵⁰ battelle.org

Battelle's headquarters, adjacent to Ohio State University, pulls from the local university talent pool, but has very few direct relationships within the university system more than other nonprofits and local corporations; it operates 95% inside its walls, 5% outside. PI's is mostly just in conferences and structured program. In fact, this culture remains in many of the satellite operations as well. Many Battelle labs are remote—outside of local 'ecosystems' (a federal lab culture); according to its website, it appears that the majority of Battelle's interaction with the community rests in support for direct educational programs (e.g., STEM programs), community [what?] and professional research sponsorships.

Testing & Prototyping, Externalized Technology Transfer

To create a more robust technology transfer process, Battelle Ventures was created as a separate entity in the late 1990s. Battelle Ventures and an "... affiliate fund, Innovation Valley Partners (IVP), have a combined \$255 million under management to create and accelerate the development of early-stage technology companies with breakthrough solutions to key market problems.¹⁵¹ According to former employee, Thomas Pounds, it was difficult to exact cultural change via innovation and maintain fiscal objectives of the organizations.¹⁵² Following the early Xerox technology example of profiting from external ventures and a huge windfall for Battelle, the IRS figured out that Battelle was making money—became visible, and state of Ohio repurposed. (750 mm). Unique model for example of how Battelle ventures would connect between new technology developed in national lab, and commercialization—at NREL, which Battelle managed, a VC funder hired EIRs and placed within labs. DOE ok'd at NREL. This is a way to be closer to the technology, and VC has ability to then be the catalyst within the lab.

Sandia Labs, in Albuquerque, New Mexico, is under the auspices of U.S. Department of Energy (DOE), and does pure R&D and testing, with approximately 60% of its focus on nuclear energy and 40% in renewable energy. Unique to Sandia, this lab has a large testing site 20 miles from its headquarters. As it is an exclusive DOE lab, Sandia has few unique partnerships with industry, although that has been changing. Several commercial companies operate on site, partner with Sandia researchers, and participate in activities at its testing site and along with various federal agencies, universities, and private companies. At Sandia, Technology Transfer (TT) activities are handled by main office, but the TT office's infrastructure is focused on more transactional activity, and in part, given the distance from the testing site, it is incumbent on researchers/PI's to initiate both industrial partners and alternative funding sources to continue research. In addition to internal activities, a Sandia organizational 'spin out' Technology Ventures was developed to support the lab (and other labs) with technology transfer administration

Currently Sandia is exploring a long-term relationship with universities on a 'term abroad' project called Solar Campus, at their testing site. Given their large hardware and facility infrastructure, and existing ad-hoc engagement with universities, Sandia is pursuing opportunities to grow this capacity. Many federal labs have a significant set of physical resources, built up over years of contract work that supplied many of these resources. Although it is feasible that its resources could be used for other purposes and by outside groups and organizations, after the purpose of the specific grant, the labs have traditionally kept their

¹⁵¹ <http://www.battelleventures.com>

¹⁵² Conversation with Thomas Pounds, 12/2012

resources internalized for real and perceived security and liability issues.¹⁵³

Conclusion

Thus far the organization's flexibility to adapt to local conditions has been locked in its mission, and the culture of a large organization. As noted, Battelle employ an expansive business strategy of services to consulting in order to support its efforts in the R&D 'supply chain' —from operations and consulting services, to strictly contract R&D. As for Draper it has explored new approaches to partnering and convening as particular agents within the organization have initiated projects that connect it with similar labs with a wider net of activities and opportunity. Additionally, with personal relationships, specific projects, and external research institution efforts to look for partners to support their internal activities, these organizations have begun operating satellite facilities.

Is there room for an intrapreneur within a contract R&D laboratory? The common denominator in many of these stories is an internal champion who sees an opportunity and pursues external relationships, partnerships with other institutions and other small companies —all a bridge to future venture endeavors. Instead of focusing on the formal organizational structures that often bind these organizations, and the policies developed from the governmental side to either support or protect, it is critical to start focusing on the people within these organizations and the personal relationships that actually activate the R&D process.

VII. ANALYSIS | Economic Connectors – Understanding the Agents and Accelerants of an Innovation Economy

In light of the organizational information reviewed and the elements of the R&D-fueled innovation economy, the recurring cross-cutting themes that emerge are the strength of the personal networks that motivate and connect these agents, their activities that build the innovation economy as well as the physical places that support them, and the physical environment that helps the innovation activities thrive.

If government and corporations can refocus economic development efforts along these lines, and thus support the fundamental foundations of the economy, the country should see a robust and sustainable future. Instead of focusing on capital injections into corporations to help facilitate moves, or what they might invest in naturally to build their business, economic development initiatives should use resources to support the strengthening networks, convene innovation economy entities that are not yet connected, and reduce hurdles that create barriers for business growth. This would be a paradigm shift from the current focus on business entities to that which is more fluid, but direct support to the economy. Although business entities are a product of the people and the environment, they are starting to 'dissolve' at the boundaries into epically different organizational structures, and disperse geographically

¹⁵³ Conversation with Chuck Andraka, February 2013

Lead Agents-Leveraging the Personal/Professional Networks of the Entrepreneur / Intrapreneur

As mentioned previously, to examine the prime factors of an innovation economy —people, their networks, and the places they choose to inhabit— we must focus on the 'person' scale of activity within that economy. This person scale is appropriately called 'person-byte' by MIT researcher Cesar Hidalgo¹⁵⁴ who is mapping human activity in the innovation economy, and the 'Entrepreneurial Agent' by Maryann Feldman.¹⁵⁵

Globally, the increasing distributed nature of work of larger corporations has connected more workers to multiple locations, and has compelled more people to travel to diverse 'sites' for work. This can include work on specific projects with distributed teams, or via forming new partnerships, academic responsibilities, and conference attendance, and of course the collapsing of entities through the activity of mergers in which smaller companies in alternate locations are blended into the larger corporate structure. Although recent economic /events/downturn?/ may have increased the amount of tele-connectivity (video-conferences, collaboration software) to supplement and replace previous physical travel budgets, face-to-face meetings still are necessary for innovation productivity, with frequency depending on the nature and phase of a 'project.'¹⁵⁶ Despite the advantages to technology to increase interaction in general, face to face meetings are still important for innovation productivity due to the advantage of more effective personal relationship building, and their immediacy and multi-sensory humanistic qualities that are necessary for full knowledge transfer.

The intrapreneur, in particular, is faced with the dilemma of open exchange between the organization and external agents, as ideas center around specific intellectual property. As the global corporation has increasingly factored the distributed workforce into their intra-company infrastructure, a broad variety of tools can be employed for more efficient project management, scheduling and information transfer. Many corporations allow/and many encourage the individual researcher/intrapreneur to research and publish articles with an outside collaborator, in some cases in a region far from the intrapreneur. These tools allow the intrapreneur to reach beyond a particular geographic location, and depending on the makeup/locations of the collaboration team, spin off activity has a potential to occur in many different locations.

Technology as Enabler

No analysis on contemporary networks can be done without mentioning the 'enabler' of technology —digital infrastructure of social/professional networking internet sites that have transformed the way personal/professional networks form, expand, and stay 'current'. They further amplify the speed at which the innovation economy is moving. These new digital infrastructures and tools that transform our virtual worlds—can also be leveraged further to efficiently connect the business interests between places—along 'trusted' relationships.

¹⁵⁴ Media Ventures Class Presentation, MIT Media Lab, 2/XX/13

¹⁵⁵ Feldman, Entrepreneurial Event

¹⁵⁶ Rallet, Alain and Torre, Andre 2009, "Temporary Geographical proximity for business and work coordination :when, how, and where?" Spatial Aspects Concerning Economic Structures. Volume 2

Social and professional networking sites have become “borderless” directories that network people across the globe. The Linked-in site registers individuals’ locations, but there is no ‘map’ or location function supported for companies. Many people do not update their locations or current work as they might be ‘on the move.’ Additionally, although they recognize one location where they might be ‘tagged’, they move frequently to additional places. Even the online registry Square, which provides digital transactions for small businesses via cell phones, has no physical address! Finally, even AngelList, an online registry/infrastructure that supports startups (with hiring, networking, fundraising and visibility offerings) recognizes a startup’s main location, but also references the complexity of the ‘place’ by identifying the ‘parents,’ ‘siblings, and ‘children’s’ places.

Mobility and Locational Affiliations Increasing Personal Networks

Much has been written on the increasing trends of individual worker mobility, telecommuting and increasing generationally driven need/desire for flexible work environments. Certainly, these trends are enhanced by communication and transportation technology as well as generational or demographic mindset. To a degree, these factors have influenced the multi-locational nature of people’s lives, but additional factors also shape people’s personal networks and therefore their life-choice locational decisions, and work locations. These include:

- Multi-step educational paths—builds personal ties to many places as people pursue various degrees, especially given the economic cycles when people go back to school
- Broader connectivity — easier to keep in touch across many ‘communities’ simultaneously through social media and email.
- Shorter ‘job’ spans and desire to move freely to new jobs
- Scarcity of jobs/opportunities in a particular locations combined with multiple career households

Many ‘populations’ could be considered in analyzing innovation economies — from multi locational co-founders of startups, and thought-leader entrepreneurs who mobilize multiple communities of innovation to researchers with joint teaching/industry appointments, academic research couples who work in universities on opposite coasts, and even captive ‘cohorts’ from graduate programs such as MIT’s MBA Sloan Fellows (120 people from 34 countries with career experiences in multiple nations/cities, all interested in innovation best-practices for their diverse employment sectors).]

Within the United States the increasing mobility has been noted to provide a marked effect on innovation, and knowledge transfer. As Paul Kedrosky, entrepreneur and senior fellow for the Kaufmann Foundation (noted foundation supporting entrepreneurship) has said “Mobility creates flux, and that drives energy and human collisions. The result is vibrancy, entrepreneurship and economic energy, or the lack thereof. Mobility is the economic social network that matters.”¹⁵⁷ Although the indicator of migration patterns is a useful tool, there is limited data on multi-locational activity. Although people are moving, a part of their activities may remain in previous locales.

¹⁵⁷ Paul Kedrosky, “Migration in America, Vibrant Flux” in Forbes, online, November 16 2011. <http://www.forbes.com/special-report/2011/migration.html>

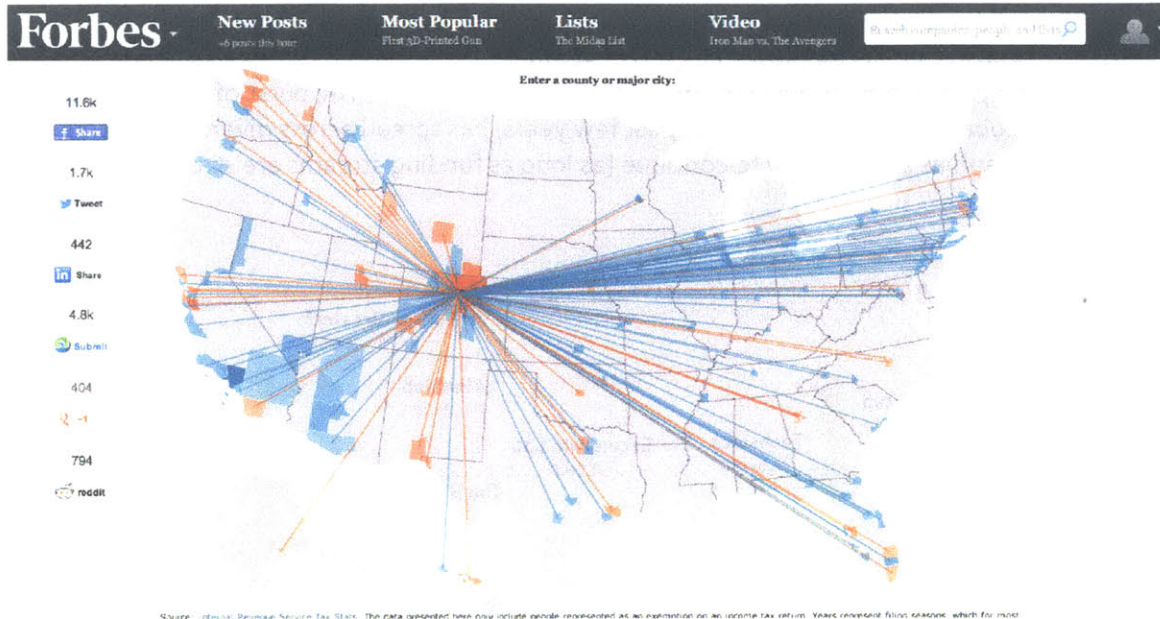


Figure 14: Forbes presentation of Interactive Migration Map, based on IRS data <http://www.forbes.com/special-report/2011/migration.html>

The changing nature of work and corporations are a parallel for the role of clusters vs networks in cities respectively no longer do workers have to be in a big place, but they just need access to a big place. Some people can be as visible in a small town on a big stage as others can be in a big city [on a small stage?]. For example, New Haven has many senior level professionals and core talent who work in New Haven, and live part time in New Haven and part-time in New York and/or Boston. The transportation connectivity in this region ably supports this movement, but having a personal network is a critical facilitator for this modern on-the-move lifestyle. However, the personal network has become blended with a professional network, and the 'boundaries' between personal and professional continue to blend thanks to the ever-expanding social media tools. Increasingly, given employment scarcity, and the plethora of mediums to transmit 'job opening' information broadly (resulting in many unrelated resumes being submitted for jobs and many excellent applicants being overlooked due to computerized 'key word' resume scans), the role of personal networks for job seeks and hiring agents has become increasingly important.

Accelerators, Mentor Networks, and Organizational Visibility

In terms of entrepreneur networks, many emerging sources can 'map' or create visibility of nascent businesses, and their entrepreneurs, at a national level. These sources are both evolutionary as valuable tools to build community and visibility of activity, as well as to provide platforms for resources and funding. Networks such as AngelList, Entrepreneurs Network, LinkedIn, and Startup America have emerged over the last few years to further connect the growing populations of geographically dispersed entrepreneurs. These efforts are based on private initiatives, and are more effective than any government database, as they are specialized and are spread through media that appeals to the demographics of interest.

Entrepreneur networks are also built by specific cohorts that entrepreneurs belong to, and the increasing number of 'mentors' who are accessed through those places. Many successful serial entrepreneurs move through accelerator programs (often more than one), and because they

are 'application based' they attract entrepreneurs from a sprawling geographic landscape. During their time in that accelerator, they will develop new relationships within a specific geography, and personal relationships among the 'cohort' of peers. The burst of accelerators and similar 'incubation' activities over the past few years, has spread across diverse networks and wide geographies and is likely to continue [as long as funding streams are strong?].

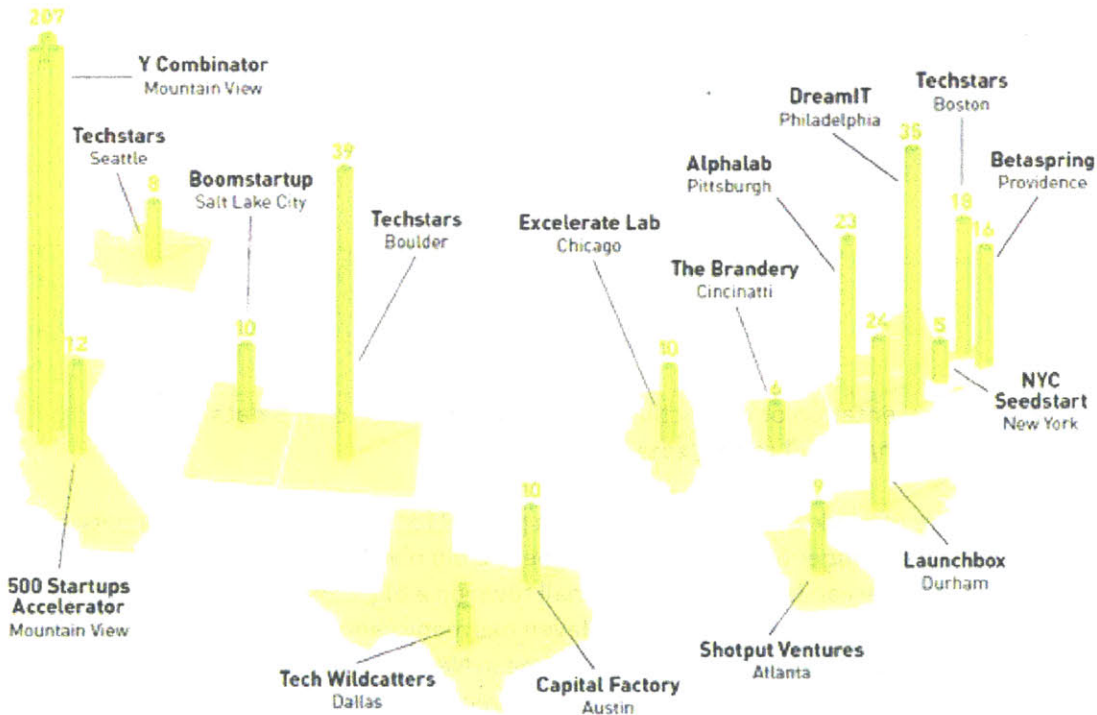


Figure 15: The leading incubators (in terms of applications per seats) in the US as of 2011, and they are ever growing.¹⁵⁸

Although some accelerators/incubators are funded through resources that is expect ventures to spin off the activity locally, many entrepreneurs are influenced by various factors that pull the venture to another location such as the funders (the mentor network), specialized customer or talent pools, social and emotional ties to a [distant?] place, or the availability of resources required to grow the company. In a larger, more established ecosystem, these factors might be easily located, and the venture can remain local, but in a smaller or less mature environment entrepreneurs must be mobile. However, if the advantages of a local place are more evident (e.g., affordability, quality of life, 'stickiness', talent base, client base, family/social network ties) and are included in part of the immersion of the accelerator, the venture may be able to retain part of the organization where it makes the most sense for personal decisions.

Externalization and Extending Relationships

Municipal and state economic development corporations, and governments, rarely 'expand' globally. Increasingly, in the competition to lure more business activities to a place, governments spend huge marketing budgets to brand and represent their place in foreign

¹⁵⁸ Shani Shoham, "The Complete Guide to Incubators" on Shani's Business Review Blog, September 11, 2011 <http://shanishoham.wordpress.com/2011/09/11/guide-to-incubators/>

venues—conferences/tradeshows, external business development ‘missions’ to visit with corporations, online marketing, etc. In general, although these exposition booths are use useful for arranging pre-determined meetings or chance encounters with interested parties, they do not attract hoards of companies focused on technology transfer and exchange opportunities — these folks are generally in another part of the convention hall in ‘partnering’ sessions.

These types of ‘external missions’ play a critical role in the economic development corporation, as they are a primary avenue for forming relationships. However, these externalized efforts are very much one-dimensional in that they focus on bringing the place to the external environment, purely to bring back new business to the original place. These missions are generally led by a particular ‘business development officer’ in combination with a government official who is a key spokesperson for that place.

Certain organizations like General Assembly in New York, a co-working ‘club house’ and the co-working spaces in the heart of Silicon Alley, have become one of a ‘satellite resource’ for a city and its diaspora. As the co-working space was founded by a core group of Yale alumni, it serves to form and grow ties between the diaspora/alumni of Yale, and the professional networks formed there and after leaving New Haven. San Francisco’s Economic Development Corporation has also instituted international ‘liaison’ offices in several key locations like China to help shepherd business prospects back to San Francisco, modeled after efforts such as the UK Trade and Investment Satellite office models. Seth Pinsky of NYCEDC has taken a different route, citing concerns with efficient use of resources in order to open physical office spaces in remote locations. He suggests that more targeted ‘trade missions’ to develop relationships and provide visibility for startups are more effective than a physical space in the short and long run.¹⁵⁹

Conventions/Conferences

Although industry conventions may not be directly increasing in number, their content and makeup are increasingly being directed towards specialized activities that benefit the direct desired outcomes of the events—in terms of content, scheduling, and by providing suitable ‘spaces’ for such interactions to occur. Refocusing on using the conference as a supportive temporal community for personal relationship-building will further benefit the creation of innovation economies. The increase in the number of ‘un-conferences’ or participant-driven content of conferences enables participants to customize their networking experiences so as to produce the most effective networking opportunities for attendees, and a ‘mission driven’ knowledge transfer that may in fact promote more rapid venture creation.

Traditional economic development models look at conferences and conventions as a pure hotel/restaurant income play,¹⁶⁰ but increasingly more progressive conferences engage the multi-locational mobile entrepreneur set and help them integrate into the local ecosystem.

¹⁵⁹ Seth Pinsky conversation 4.15.13

¹⁶⁰ SXSW’s Economic Impact report on the 2011 festival states a \$168m economic impact, based on traditional economic impact models. Media attention, 50,000 hotel nights, etc., are measures of success. Other measures that may have a longer-term impact and not likely counted are the more long-term effect of businesses considering Austin as a location, or startup co-founders locating there based on their view of the lively city, or even the impact of activity in nearby locations of SXSW (exposure to certain things may spawn activities in other places).

Austin's annual South by Southwest® (SXSW) conference/festival holds a 'coworking confab' just before the actual SXSW event to help attendees network and build entrepreneurial support across locational boundaries. SXSW, which boasts a "unique convergence of original music, independent films, and emerging technologies ... [that foster] creative and professional growth alike,¹⁶¹" and other similar conferences host multiple 'open houses' at regional co-working/innovation business headquarters, replete with local programming. Additionally, corporate involvement in these conferences has shifted from exhibition floor 'booth occupancy' to taking over whole blocs of cities for demonstrations of technology and/or culture, and to 'host' networking events for greater exposure. SXSW even offers a networking site during the festival (SXsocial.com) that enables SXSW participants to "connect with new colleagues and friends before, during and after SXSW 2013."¹⁶² During the March 2013 SXSW conference in Austin, Google Village took over a local neighborhood including 10 houses just a few blocks from the Austin Convention Center to network, recruit and promote products, including Android, Developer, Discovery and Maps.¹⁶³ This move brought people out of the 'convention' and to different parts of the ecosystem and localized economy. Although the local impact is short-term and is still based on hotel/restaurant impact and revenue, the increased exposure to a place can spur further connections between people through geographic familiarity (people willing to travel to a place that they know, and contextual understanding is increased).

Typical research and university convenings around specialized topic areas have additionally provides researchers, corporations, and small companies a means to connect around specific industry topics. Although these are held in a singular location, and on a smaller scale than a convention, they bring in people from across regions and nations. As discussed previously, these events can reveal and facilitate new collaborations among participants. These events are often financially supported by local economic development entities (cities, non-profit industry organizations), as well as by corporations.

Evaluating Networks and Measuring Connectivity Leads to Supportive Infrastructure

Currently, our economic development 'metrics' of success struggle with representing the activity of innovation on the municipal scale, let alone the individual. Federal and state records, along with industry registrations, have historically been unable to accurately model the dynamic nature of people, except as 'jobs,' and even then that data is subject to a significant time lapse between filing and reporting and then release to the public. Getting local municipal data in New Haven was very difficult for my staff at a New Haven economic development agency, as most federal- and state-based measures were locked in the regional Metropolitan Statistical Areas (MSAs) or industry trade areas (i.e., NASIC), which are numerous and unreliable as they are subject to corporate self-reporting data. Getting to the neighborhood scale was even more difficult.

The fourth economy of multi-locational companies is completely hidden in the picture of a region's/city's economic growth. Company profile data are squeezed between macro and state-level micro data, obscuring their actual scale of activity and economic impact and thus the overall footprint of many companies in a city/region. For example, if company x has five

¹⁶¹ <http://sxsw.com/>

¹⁶² <http://social.sxsw.com/sessions/new>

¹⁶³ There has been heightened critique of the corporate influence on 'indie' festivals, potentially affecting the 'success' of these events...

locations with 50 people each, registered with one headquartered site in the city, that company would be considered a 'small company' in most locales, but is operating nationally as a company of 2500. Secondly, globally relevant service companies (or institutions) appear on a local radar screen at a certain scale, but their consultant and client network is worldwide, and their economic impact broader than a specific place. Global corporations like Sprint, based in Kansas City, or even smaller but globally relevant service firms like Architect Cesar Pelli & Associates in New Haven have just a few staff in their main city, but have affiliate companies in many other places, and clients that are connected to New Haven from all over the world. More and more smaller firms, especially in the service industry, are simply a network of independent small companies, forming, growing and shrinking across multiple places as needs arise.

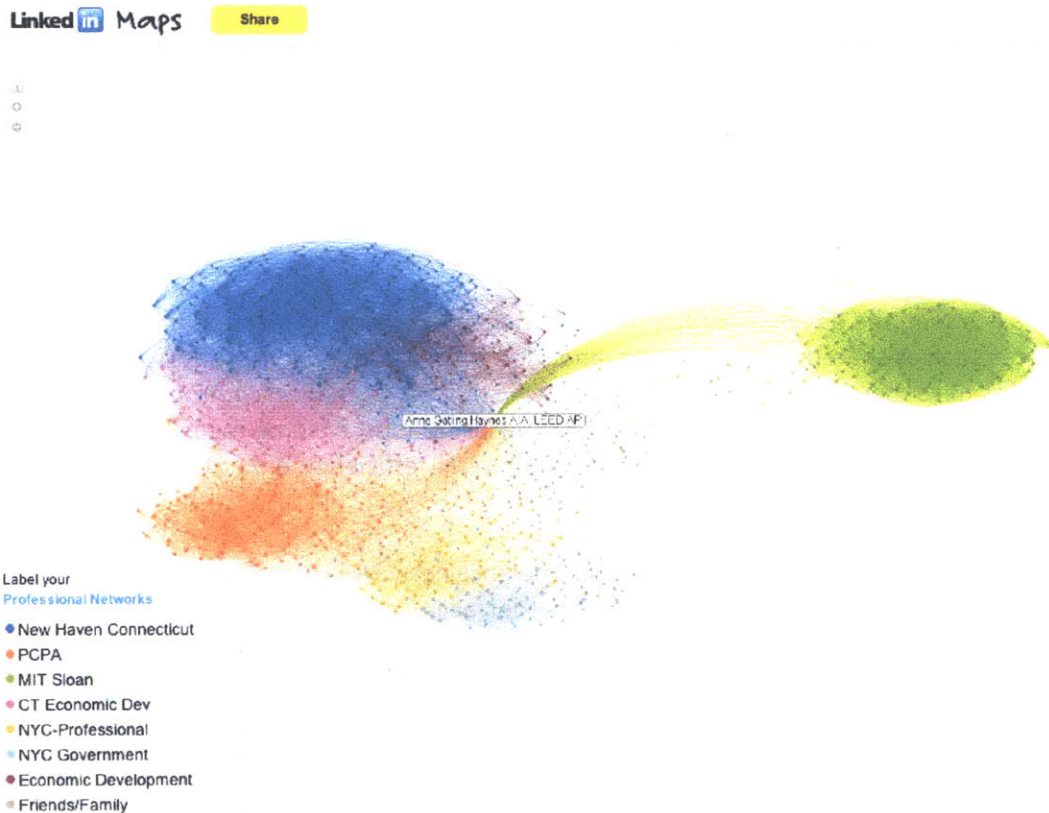


Figure 16: Above is a map function, provided by the professional networking site, Linked'in, created from the author's network, which attempts to map personal 'spheres' of connection. A link is not provided in order to protect specific contacts.¹⁶⁴

Conclusion

However, in conclusion this is not to say that with all of these accelerants, that we live in a virtual world, or that we live in many places at the expense of place. In fact, place has becoming more important. These networks, as virtually connected and distributed as they may be, still occupy 'places'. Although dynamic in nature, the elements of these networks, the people, will choose certain a 'home base' for living based on certain factors, and find a way of working and getting together with the remainder of their network as is convenient and further supports their

¹⁶⁴ <http://inmaps.linkedinlabs.com>

efforts. Driven by a person's intuitive need to draw identity from that cultural context, it is becoming more critical that we develop an infrastructure locally that engage people, but facilitate their 'freedom' to build commerce and the economy as driven by economic currents.

Contextual Accelerants - Facilitating Growth Through Understanding the Role of Place in the Innovation Economy

Fundamentally, our relationship to place is changing as our work and social lives are changing, due to the transformative nature of technology. As reflected in a recent article addressing presentations at the American Planning Association meeting, "*Our built environment has been designed to accommodate the ways that people worked (and lived) 20 or 50 years ago. So now what happens when our behavior changes, when the ways that people move through and need to use space across cities no longer matches some of the ways we've built them?*"¹⁶⁵ In effect, place has become more critical, but it has to be supportive at a hyper-local and hyper-global (i.e. connected) level at the same time, and that work and life are increasingly happening in spaces that were once exclusively for more singular functions .

Shared Asset Models for Further Collaboration & Networking

Recent years has seen the development of more efficient corporate organizational infrastructures such as shared service centers, and the consolidation of non-profits whereby a few non-profits have merged to shared administrative services. For a local community these efficiency moves create tension as it generally means a loss of jobs, or some measure of loss of 'identity,' All benefits coming from the organizational overall 'efficiency' are not shared with the local place.

Many of these emerging corporate ventures, and freelance networks that provide critical support, have grown in parallel with shared asset model facilities and services. These shared assets most importantly provide a proxy for 'community' across specific needs of individuals, allowing people to broaden the opportunities for learning and knowledge transfer, as well as more efficiently socially connect with the activities within a specific place. With Increased mobility and multi-locational existences, the emergence of shared assets like AirB&B, ZipCar, Coworking, entrepreneurs and venture co-founders can be more 'plugged in' and ready to 'play.' These are resources that effectively lower the bar for business development and knowledge transfer—both in affordability and risk. As Robin Chase, founder of zipcar, has described—the opportunity provided by "*excess capacity and platform for participation*" is the next wave of 'right sizing' and innovation in the economy, while building community making our personal experiences richer.¹⁶⁶

Additional to mobility services as mentioned above, there are a second 'version' of these resources that allow companies to get equipment (and other sophisticated services) resources for shorter time periods—especially helpful to companies in the second/third stages of growth

¹⁶⁵ Badger, Emily, The Atlantic Cities "How the End of the Traditional Workplace Is Changing Our Cities", reporting on presentation by Adam Stoltz, 19 April 2013, <http://www.theatlanticcities.com/neighborhoods/2013/04/how-end-traditional-workplaces-will-change-cities-around-them/5343/>

¹⁶⁶ Robin Chase, Lecture 5.2.13, MIT Media Lab

where they are creating prototypes/proof of concept. Tech Shop as mentioned above is a commercially expanding maker space that has a breadth of lo- to high-tech equipment that allows for access to the facilities on a membership basis. Many places have self-organized very loose versions of these, especially in creative economies, such as MakeHaven, in New Haven ¹⁶⁷, that is now a thriving community space, location to build prototypes for nascent entrepreneurial activities, and part of a larger nationwide network of similar facilities.

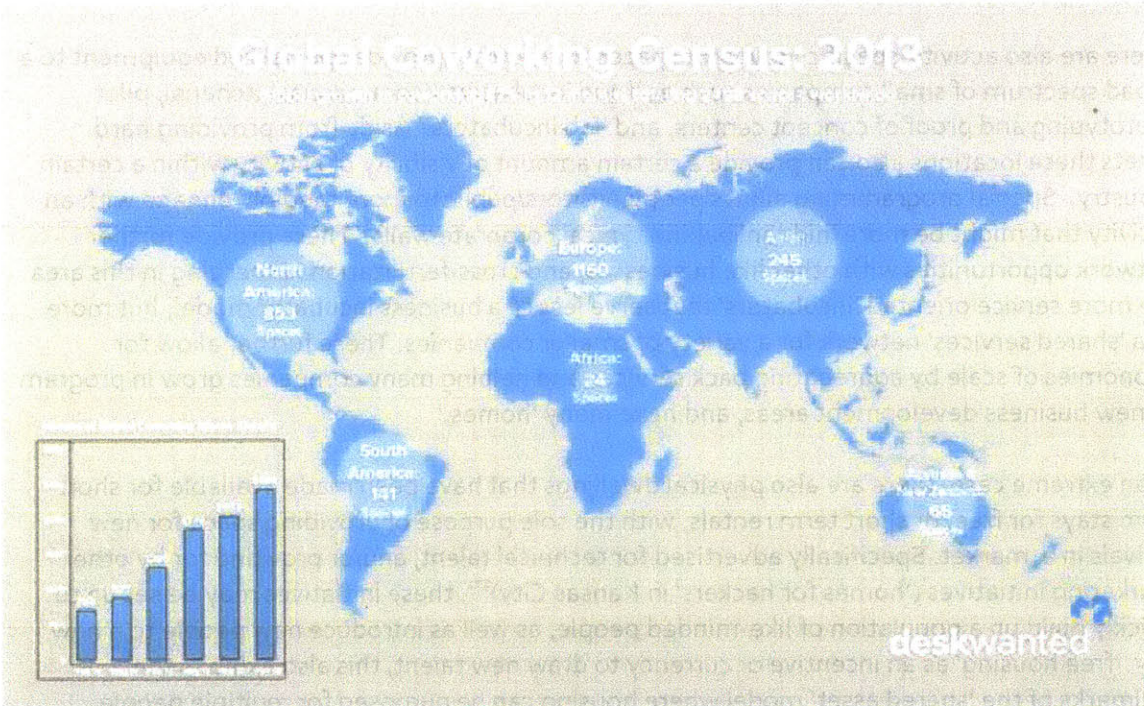


Figure 16: Global Co-working locations as reported through the 'Global Coworking Census 2013'¹⁶⁸

The increase of shared access facilities allow people to quickly connect to social networks of like-minded individuals. These occur in both singular large cities (NYC: General Assembly) as well as smaller cities (New Haven: The Grove), and function similarly in both locations. There is also an increasing trend of replicating these models in additional locations, generally under the 'brand' of the original success. These range from early stage expansion models General Assembly, CIC which represent singular expansions into new markets to more distributed models such as the Center for Social Innovation, the Hub which are now established global networks. Aside from new social networking opportunities, these spaces offer specific resources such as workspaces, educational programming, diversity of people/companies/industries and a variety of meeting options¹⁶⁹. Most importantly, through the social networks affiliated with these resources, people quickly share advantages and

¹⁶⁷ MakeHaven, makehaven.org: initial founding by a group of entrepreneurs who needed a space to build prototypes, co-founding through convening by EDC, of which author was lead convener.

¹⁶⁸ "Coworking Boom Continues" on Small Business Labs Blog, <http://www.smallbizlabs.com/2013/03/coworking-boom-continues.html>

¹⁶⁹ For example, the General Assembly space has been more successful in supporting Yale alumni in New York than the Yale Club

disadvantages of a place, more effectively than traditional means like Chamber of Commerce monthly meetings. These spaces serve populations at the local neighborhood level, regional level (a hub for innovation activity) as well as support an increasingly intra-city 'geography.' Many people now look immediately for these shared asset resources as a sign of connectivity and relevance, and as a primary 'portal' into the local economy. Corporations are using these resource centers more and more as a way to support their employees in a creative environment separate from the workplace, allowing the workers more flexibility in where they live¹⁷⁰

There are also activity-specific incubator spaces that further provide specialized equipment to a broad spectrum of small companies such as 'food incubators' (commercial kitchens), pilot prototyping and proof of concept centers, and 'lab incubators.' Aside from providing hard assets these locations also can provide a certain amount of visibility of activity within a certain industry. Special programming allows people/visitors/public to more tangibly engage with an activity that might be more 'hidden' behind typical corporate walls. These provide further network opportunities with other like businesses, and cross-fertilization. Emerging in this area are more service oriented 'incubators' that serve less of a business incubator model, but more of a 'shared services' network for a variety of smaller companies. These further allow for economies of scale by aggregating back services and helping many companies grow in program or new business development areas, and have many 'homes.'

In an extreme case, there are also physical dwellings that have been made available for short term stays for free, or short term rentals, with the sole purpose of providing space for new arrivals in a market. Specifically advertised for technical talent, and/or provided for by other marketing initiatives ('homes for hackers' in Kansas City)¹⁷¹, these initiatives may be set up to quickly build up a population of like-minded people, as well as introduce new people to a new city. 'free housing' as an incentive or currency to draw new talent, this also exhibits the hallmarks of the 'shared asset' model where housing can be purposed for multiple people, efficiently sharing a resource for the 'on demand' time period that might be all that is necessary for the individual to accomplish something they are looking to do.

'Proof concept' cities is the newest iteration of this. By providing data as a platform for new companies, or by engaging directly with young companies to demonstrate/test new products and services, Cities are becoming the latest 'incubator.' Dublin (IBM), New York (Big Data initiative), San Francisco (example) and others have provided their data 'free' in order to help catalyze civic engagement as well as encourage new ideas to sprout up. This is often kick-started by a variety of 'prize based' competitions that raise the visibility of the opportunity as well as provide marketing for the city to demonstrate it's it-city status (not IT, but 'it', like the 60's it-girl phenomenon). Smaller cities have been able to encourage the growth of small cities by demonstrate tech in real time. For example, SeeClickFix which was an 'early' entrant into the citizen engagement platforms. After being encouraged by the city, and being able to pilot the technology in first the neighborhood of the founder, and then the city with the participation of the city, the company has since grown international, and their platform adopted to many

¹⁷⁰ Dishman, Lydia. "The future of coworking and what will give your business a huge edge", Fast Company, <http://www.fastcompany.com/3004788/future-coworking-and-why-it-will-give-your-business-huge-edge>

¹⁷¹ <http://www.homesforhackers.com>

specific needs of different localities.¹⁷² Greywall Software was launched by a former GE IT leader, Sukh Grewal, who wanted to stay in Connecticut, but recruit heavily from Yale's computer science program, retaining some of his 'team' from prior employ. He had developed collaborative applications prior, for a multi-locational global corporation, but wanted to look at crisis management collaboration tools for Cities, and other similar large entities that have to work with multiple divisions within an emergency. The Economic Development Corporation, EDC¹⁷³, facilitated a partnership with the city to test and launch an early prototype. This process allowed for the formal birth of the software, and more importantly by working with the city divisions, provided a better dialog about the topic of crisis management, leading to improved performance during Hurricane Sandy.

Local Place Characteristics that Connect and support R&D

Though increasingly connected, the person still thrives in a place that catalyzes serendipitous encounters, creative inspiration, and the dynamic integration of populations (demographic and ethnic). Given the broad diaspora of Cities, and Institutions, people now have multiple allegiances to place, and will consider that mental landscape of place options in making decisions about business location or activity. Therefore, urban economic development policy should shift to support the soft infrastructure in order to support talent attraction, retention, development and quality of life, instead of relying on 'hard' policies that rely on short term ribbon cuttings and project-base 'wins.'

Urban areas work to facilitate the spectrum of environments needed for innovation which is both creative and applied work. Many have spoken to the advantages of density of population, More importantly, the diversity of talent, industry types and people are further catalyzers of activity within a place. Finally, the influx and outflux of talent, regularly, seems to have a beneficial impact of 'new thinking' and exposure to knowledge from other places, and as mentioned the vibrancy of migration promotes more potential integration of populations and therefore ideas/knowledge transfer. The last section explained how co-working and other like facilities are newly critical front doors for the flow of people in and out of a place.

¹⁷² Founder Ben Berkowitz has become a thought leader and ambassador in civic engagement, very mobile, and represents New Haven and the opportunity there for tech cofounders. His personal and professional network is vast, creating a relevancy for the City.

¹⁷³ Author was CEO of the EDC from 2010-2012, helping facilitate new programs and services to grow emerging companies in New Haven, activities formed the basis of this thesis and related proposals at the back of the document.

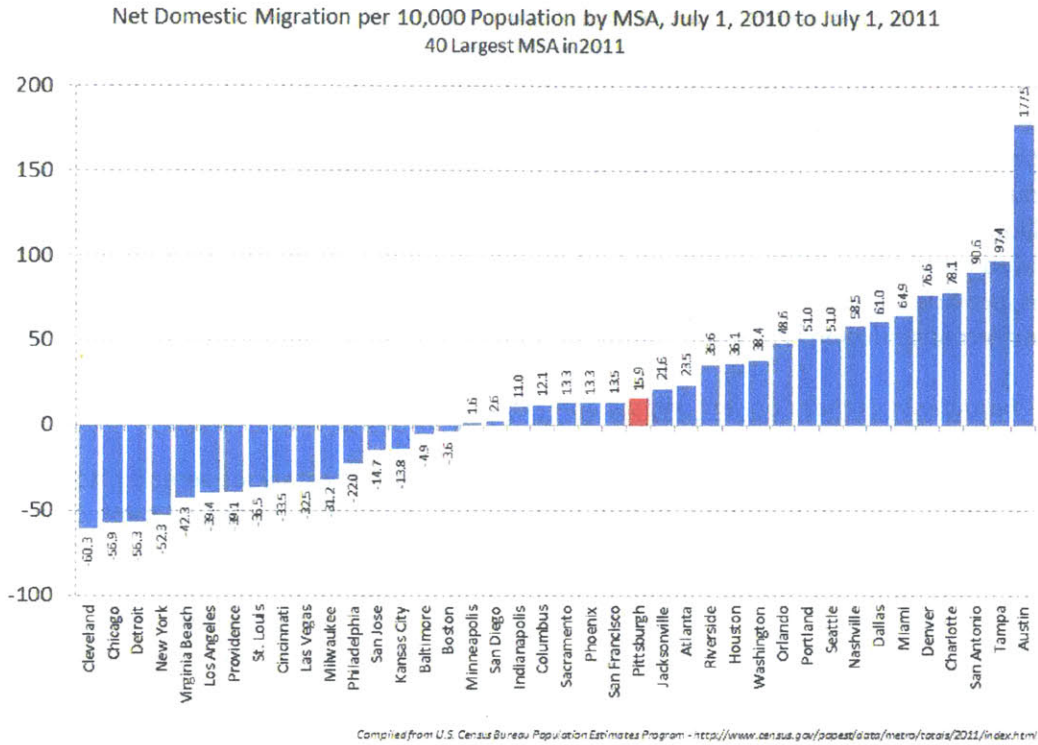


Figure 17: Image shows the overall migration into secondary markets/smaller cities. Although the base information was drawn from the US Census Bureau, the graphic was located on a personal blog, and should be verified.¹⁷⁴

Glaeser/Kerr outlined the richness of economies that have a density of smaller firms in their work....Feldman & others on the productivity and jobs growth of smaller firms vs. larger firms. The diversity of industry types, and robust engagement to a place increase the chances for cross-industry 'fertilization' of ideas and innovation. Economic Development activities in recent years, driven by the desire to 'create clusters' and easy political wins, have become hyper focused on netting a larger singular firm to an area rather than build a network of 'commonality' among smaller firms, and using that to leverage scale/visibility of activity in a place. The larger entities, by their nature, are becoming multi-locational, and even if net new jobs are created by moving in the new business, it is rarely engaged in the specific place

Supportive places, such as cafes, have been productivity engines as it allows one to be alone, but with other people, and facilitates the opportunity for chance encounters. Without obligations and direct ties to people, people can remain in 'creative' state (focus, alone), but also connect at instances to facilitate knowledge transfer. The 'shifting kaleidoscope'¹⁷⁵ of environments in an urban area is very supportive of creativity, and ultimately productivity. However, it is not just the singular place that is an advantageous to an innovative economy, but the relative closeness between multiple locations that are supportive to 'chance meetings' in

¹⁷⁴ http://www.austinrealestateguy.com/blogs/sam_chapman/archive/2012/05/01/inward-migration-to-austin-compared-to-other-cities-off-the-chart.aspx

¹⁷⁵ Susan Cain, *Quiet*, AudioBook Chapter 4, What Creativity Needs for Focus (New York: Random House 2012)

between periods of working, or meetings. The ability to build on a successive series of inspirational and productive conversations are truly a benefit to these more impactful districts.

Another advantage of the smaller cities, and city networks that have beneficial transportation networks, is the value of time as it relates to minimum time commuting, and accessibility between places. This allows for a maximum time convening, meeting, and working. Cities with longer commute times have potential distributed workforces, and the social bonds between employees less impactful as they less often socialize together. Autodesk considered it's new location within the 128 belt based on 'optimizing' for employee residential locations (did this end up just giving everyone a commute time), which kept them on 128 rather than moving into Cambridge. Kayak located in the 128 belt, Concord, to please the majority of chief engineers to minimize their commute time to work.¹⁷⁶ Kendall square and Cambridge continue to lose companies and people to other local regions that have cheaper rents, generally along transit lines. It was estimated by MIT's own newspaper 'the Tech' that 100 companies had left Kendall and moved into the Innovation District in Boston where rents were nearly 20% lower (although this is also changing).¹⁷⁷



Figure 18: Diagram shows best commutes (green) which also correlate to some of the growing secondary markets with high productivity. Further work could be done to map commuting times and productivity.¹⁷⁸

¹⁷⁶ Conversation with Giorgos Zacharia, Kayak

¹⁷⁷ Mike Farrell, The Boston Globe, April 13, 2012 and reposted at the Tech: <http://tech.mit.edu/V132/N18/kendallsqueeze.html>

¹⁷⁸ Joe Mont, "Bundle and The Street Special Report, America's Best and Worst Commutes" on Bundle (December 9, 2010) <http://money.bundle.com/article/thestreet-and-bundle-special-report-americas-best-and-worst-commutes/>

People are moving, and people who run companies move too. Places that are more available to people arriving and departing and being in multiple places part-time are perhaps more flexible for this emerging trend. Many companies grow in one place, and move to another for a variety of reasons: life choices, financing, supplier / customer relationships. There have been many concerns raised about 'talent retention' especially in some of the older cities. This seems to be episodic spasms perhaps driven by specific economic development policy conversations, but the focus is often on companies 'leaving,' and not balanced by what's growing, or coming. Boston in fact, even the 'cluster' that is robust, worries about the same thing as smaller cities— if they grow here, why can't they stay here? In fact, despite the robustness of the economy in Massachusetts relative to other States, in a recent editorial the Boston Globe opined: "THE BOSTON innovation community is full of stories about the ones that got away — the scientists, engineers, and entrepreneurs who earned their credentials here but chose to set up their businesses elsewhere."¹⁷⁹.

History and Emergence of Innovation Supportive Districts

Historically, the more recent waves of urban regeneration follow particular patterns—existing districts abandoned, the arrival of the 'urban early adopters' such as the creative class, emergence of supportive social spaces such as cafes galleries and independent initiatives, and then a broader 'identity' of a discoverable place with a distinctive culture. This pattern has played out in many waves, Soho and Chelsea in New York City to the global dominance of the Brooklyn brand, but most often centered around quality of life, and neighborhood identity. Jane Jacobs spoke broadly about the need for protective regulations to maintain the character or a the vibrant diverse street, which creates supportive social economies. Conversely, in Professor Glaeser's book 'The Triumph of the City' he argues for more density to preserve a certain amount of 'affordability' to urban districts—countering Jacobs desire for preservation as a driver towards exclusivity, and mono-cultural 'preciousness' of districts. However, although both support 'active street life' and diversity of activity, their models are focused more purely on residential and SME commercial businesses, and not specific on the diversity of business types in district as a healthy catalyst that might help boost innovation productivity.

What has been more remarkable about the most recent trend of this type of 'gentrification' is its blending with an overall dispersion of economic activity, the rise of small batch manufacturing, and other kinds of independent entrepreneurial ventures broader than the traditional SME's. In parallel to the overall 're-urbanization' of cities that has shown an overall interest in connecting to and moving back to urban environments for a variety of reasons, there have been full throttle efforts to consider the work-district in light of a 'quality of work life.' Increasingly cities have adopted and understood the benefits to 'mixed use' development and 'transit oriented development' and started implementing policies to generate smarter and more supportive programmatic diversity. These types of developments help foster better active street use, increased connectivity to other parts of the city, helping for flow. However, most of these initiatives are driven by a developer's process, and a hyper focused 'parcel-view'. Even with the best of intentions to broaden the 'connectivity' of a development to more integrated district approach, these projects are generally more one off.

¹⁷⁹ The Boston Globe Editors, <http://www.bostonglobe.com/editorials/2013/02/25/open-boston-how-freer-civic-cultural-life-helps-region-retain-innovators/mqoKS1BCFEkPdQgmoQhtrL/story.html>

Separately, there are many efforts to plan and 'brand' parts of the city as thematic 'cluster' locations in order to attract and grow an industrial cluster of sorts, but it is rarely considered as a true mixed use district that supports the full 'cluster needs'—it generally is translated into a strict real estate play. Success is likely to live somewhere in between these two paradigms, and district initiatives should be considered holistically to integrate the industry brand with a true understanding of 'mixed use,' from a programmatic standpoint, that supports both the innovation drivers of knowledge transfer, chance encounters, connectivity, and diversity of industrial uses.

District Development Planning efforts often serve as a coordinating device to align efforts/connect economy, engage in opportunity, provide for local growth. These efforts to concentrate initiatives in one area help promote the visibility of opportunity in an area, enhancing identity of the industrial make-up and core competency of an economy. These efforts can be a long-term strategy for developing a supportive environment for an innovation economy, but the key is to make sure these efforts is more about growing the infrastructure (hard and soft) to promote growth sustainably rather than a more simple branding and real estate play. However, like any urban project there are challenges, financing is dependent on developers willing to take risks, the public agencies that can support the project are often underfunded, and there may not be an appropriate governance structure in place that can execute the project over the long term. In any district there are multiple landholders, public and private, and no one developer can effectively create a district without a partnership with at least one of the major landholders, sometimes triggering local political or community concerns.

For example, over successive 2 time periods of growth, and 'opportunity' as promoted by motivated political leadership, New Haven was able to promulgate and grow a 'Life Sciences Cluster.' In scale, of course (to Cambridge and San Diego), it is a small 'cluster,' but verifiably impactful to the local and state economy, and vital to the Nation's development of innovative health options. In the 80's, with the abandonment of a former industrial site (Winchester Arms) in New Haven, the efforts to brand, site and grow emerging bio-tech start ups in the 'Science Park' area. In the 90's Yale University bought the 'West Campus' in a neighboring City to New Haven, a former Bayer Facility that comprised 2m SF of 'state of the art' corporate spaces on a 180 acre campus. Although the strategic plan for the area was in fact catalyzed by the purchase, it has driven the University to think more broadly about its role in the overall (vs. just New Haven) economy. Due to the current political and tax base structure economic development policies/incentives, and despite the Universities desire to invest in activities beyond the pure academic mission, and the messaged desire to 'think regionally' regarding the opportunity of this development, the site remains in tension. However, the facility remains remote from the main activities (and research basis), as an isolated corporate campus can only serve certain activities, such as pure research and/or events, and until full occupation suffers from isolation.

Finally, the effort to develop the area around the New Haven Train Station has a long storied history, since the 1910 'Plan for New Haven' which looked at connecting New Haven and Yale to the region. It remains New Haven's best opportunity for 'connective development.' The site is 80 acres of development/underutilized real estate spread around a 7 minute walk between the train station (10th busiest in the country, along the New Haven to Boston corridor) and the Medical Center of Yale University and Yale New Haven Hospital (14th in country for NIH funding, 5th best Medical School in the Country), just adjacent to Downtown. The State, instead, decided to 'spread its resources to its own' by increasing investments at the University of Connecticut,

located in 3 locations in the North of the State (800+ Million) to 'create' a bio-tech hub. Documents issued to the legislature did not include any reference to the existing hub in New Haven.

Looking at some other similar districts, one could draw similar conclusions about the viability and potential success of different district initiatives. NYC Silicon Alley vs Alexandria Place, the former being a more organic growth of activities around a desirable neighborhood (quality of life reasons and transportation facility), the latter being a developer and 'big development' initiative by the government and a private developer. Both developments suit different industries, with different goals, but in fact both districts could learn from each other in terms of knitting a more industrial mix (what happens in the next wave of 'biotech' economic disruption or another 'tech bubble'). Recently efforts by the NYCEDC to help seed additional districts seem to help influence direct patterns of movement, and more distributed movement (other service firms and retail would follow). For example: 'Lower Manhattan Take the 'Helm' prize incentivizes companies with money to move to a particular district where there were many other civic investments being made. This attempts to coordinate investments of different parts of the government, rationalizing the decision to make the investments, and get the companies to transcend 'switching cost' hurdles of moving during their financially fragile early years.

There have been a number of recent efforts to catalyze districts by 'character' attributes as opposed to more recent efforts to build 'mixed use' around particular civic assets such as transportation nodes (Transportation Oriented Development), and central business districts (Main Streets). Additionally, there have been continual efforts to build districts around institutions (such as regeneration efforts near to urban institutions—Yale, UPenn, Columbia Morningside Heights). More recently cities have found that doing new Institutional Development to catalyze a place, as well as seed new foundational talent development, as a way to start development prospects. This includes UCSF Mission Bay campus (Biotechnology development), and more recently NYC Tech Campus development process on Roosevelt Island (Recruiting Cornell University), and. Columbia's Manhattanville Campus expansion.

Recently, there have been numerous examples of more 'under the radar' efforts that have catalyzed and transformed communities more effectively than any one district development plan may have—both in terms of generating identity, and creating a magnet for additional activities to move into an area. In New Haven, an effort that emanated out of the Department of Cultural Affairs, after an inspiration from another set of 'retail' pop up stores in Brooklyn (temporary occupation of empty stores to test pilot new product lines or try out a new area for a retail shop). The initial project was intended to give opportunities to the city's burgeoning creative economy actors to 'decorate' the empty storefronts in the downtown area while also developing a stage from which entrepreneurial ventures could launch. This project was successful in the first round by filling 8 storefronts in a 3 block area, generating new pedestrian traffic, and launching new businesses that developed out of the temporary occupation. Better Block Intervention, starting in Dallas, also sought to develop interest in a dilapidated neighborhood by providing a platform and demonstration project to show how "communities can actively engage in the build-out process and provide feedback in real time"¹⁸⁰

¹⁸⁰ <http://betterblock.org/about/>

Finally, there has been a rebirth of the industrial zone for boutique manufacturing: NYC Brooklyn Sunset Park, New Haven's Mill River, New Market Boston Industrial Zones. These borrow and grow from initial districts in the go's such as Emreyville, California where Pixar has their headquarters. These areas are particularly attractive to entrepreneurs and a new generation of 'makers' and interesting because of their lower cost (or perceived lower cost) opportunities and a place where living and working may be feasible. These areas may be a sustainable future for district development if allowing for diverse work spaces (office/workshop), living, entertainment, and open space that allow for true 'mixed use' activity.

Measuring the Value of Innovation Supportive Places

Additionally, what is happening at the site of a supportive ecosystem (city/neighborhood) is not as visible as the more regional data that is a diluted understanding of the characteristics of the place. Other than tracking more long term metrics such as population growth (5-10 year census counts), real estate values, and graduation rates, there are no measures to assess the advantages of a place in terms of locational engagement, and social networking opportunities which could both help people understand how they might connect to a place, even if located for a short term.

Most critically, if the region's innovation activity is based on a person's social networks (personal and professional), there is not a way to easily track the person's inter-connectiveness. With increasing levels of technology that can track our movements real-time, we should be able to consider alternative measures of innovation and place that would more accurately assess conditions, predict additional opportunities, and most importantly verify the quality and outcome of investment initiatives within the Economic Development arena. Related to the movements of mutli-locational companies, and related talent, this is increasingly critical to track in order to provide appropriate support.¹⁸¹

VII. STRATEGY | A Preliminary Proposal for a Connective Development Infrastructure

New Principals for Innovation Economies: Connective Development

Included in this section is an illustrative beginning set of strategies for productive disruption to existing economic development strategy. In a true model of innovation, this section will outline broad and preliminary perspectives on how to retune the programmatic infrastructure of development support to align with the productivity of the current (and future) economic landscape. The goal of these principles is to reach ahead of existing policy, reconsider the vertically integrated set of policy frameworks to accelerate activity with minimum of interference, and open up the 'market' to 'compete against non-consumption'¹⁸² and allow new entities/people to be involved in activating their economies. Instead of focusing on the corporate/institutional anchor, initiatives should be attuned to the needs of the individual and their networks, and the supportive places that attract those people, and catalyze additional innovation.

¹⁸¹ Nothing beats 'on the ground' knowledge of a place, but there are limited means to convey 'record' and convey that information in a productive fashion, and the further macro the data is, the further removed from the true nature of the place you are.

¹⁸² Clayton Christensen Lectures, 3/4-3/6 & 3/12/13

In between these people networks, and these places, are a variety of city/state/federal public/private organizations pledged and poised to support the economy. These multitude of organizational structures are in fact, a fact of life, and survive based on the internal agents within them. Over time, these organizations will recalibrate to the economy, but in the meantime the innovation economy could thrive.

The cross-cutting themes articulated below, apply to all strategies and are the appropriate filters through which all new strategies should be evaluated.

- Reframe policy to support the smart NETWORK of the Innovation Economy—Personal and Professional, and Cities. These networks can help build capacity by engaging the network as the vehicle for innovation strategies. This analogy is appropriate within a city, between neighborhoods, and of course between cities. Most importantly, the effort is to recognize the interconnectivity of these economies, leverage those connections, which should bring growth more directly to all of the nodes in the system.
 - Build SCALE by aggregating economies in order to create a new market structure that better deliver amenities and access to a variety of environments across operating networks. The resulting scale of the aggregate system will provide a stronger foundation for financing tools, expertise effectiveness, resource availability, and multi-locational corporate engagement.
 - Identify PORTALS for multi-city entities to engage efficiently within places by utilizing these networks, thereby boosting localized economic development. Additionally, many of the multi-city institutions, corporations, and contract labs can better internally aligned their resources, expertise, and facility for effective and robust technology transfer into the local economies.
- Enhance PLACE-based Connective Development measures to infuse the supportive environments with the initiatives and programs that enhance the quality of life of a place. In the time of dwindling municipal resources, and increasing interest in hyper-localized urban environments, it has become more critical to provide a setting that works to best catalyze the creativity and cultural/knowledge exchange that is the hallmark of an innovation economy.
 - Develop programs that reinforce IDENTITY in order to better differentiate cities, and the ability for influx and out-going members of the innovation economy to 'plug and play' in a new environment.
 - Provide for alternate CURRENCIES that both provide 'incentives' for engagement that truly contribute to economic value creation, matching corporate and institutional/community needs, and reducing friction in order to better integrate.
- Reimagine innovation economy ADAPTIVE METRICS to better map and visualize the meaningful and dynamic nature of the people and places.

- Provide VISIBILITY of program initiatives and their outcomes in order to enhance better public recognition of value of innovation and its role in the economy.
- New measurements will allow REBALANCE of tax collection to provide for a more equitable structure of financial capital that supports both local place, and the network connectivity across jurisdictional borders.

CD v. 1: A Preliminary Proposal for Specific Strategies-- a Direction Forward

The following are excerpts from a working document that describes notional strategies for economic development that could be productive in accelerating the innovation economy—aligning strategies with the actual working of the economy. The reader can follow the ongoing development of these themes on [annegatling.com/connective development](http://annegatling.com/connective-development).

The essence of these initiatives were initially conceived at the Economic Development Corporation in New Haven, and developed through the course of research this year. In order to register their import and potential priority, they have been conceptually evaluated for difficulty, timeline required to implement, and locational benefit. They were developed with a sense of how they might map to implementation agency (local, meso-scale, or state, institution/corporation, or government agency). They were not developed to be a comprehensive one-size-fits-all strategy, as the author does not believe in that way of organizing strategy. This framework is meant to be flexible and adaptive to particular contexts. Strategies can be tuned for a specific context,

Most emphatically, these proposals will change over time based on further research and implementation, and the specific contexts for implementation. Like all good entrepreneurial efforts, this v.1 effort was intentioned as a preliminary framing of experiments to be played out in practice.

Proposals for a Progressive Economic Development Strategy

Please note that the following are suggestions for future research, and not fully researched proposals. They are meant to indicate and illustrate potential ways that Economic Development Strategy could be rethought in light of the themes presented in this thesis document

Category	Program Proposals	National	Meso	Local	Difficulty +, ++, +++	Timeline T, TT, TTT	Cost to Implement \$, \$\$, \$\$\$	Benefit to Localities \$, \$\$, \$\$\$	Notes/Examples
NETWORK SCALE									
1.0	Provide Connective Development Infrastructure to emphasize connectivity between existing communities within a city, and to other places to recognize scale of economic efforts, impact, and relevance in larger economy		X	X	+	T	\$	\$\$\$	
1.1	Municipal: Prioritize digital and transportation infrastructure that helps build scale of economy by connecting places more effectively								
1.2	Corporate: More support for companies to show how connected they are, improve connectivity, and encourage more of their network activities to be supported locally								
1.3	Provide mechanisms for increased visibility of impact of their work/efforts in other places								
1.4	Support the Anchors: Provide access to the expertise network (government, support services) necessary to support the multi-local companies								
2.0	Federal Tax Redistribution: In order to more equitably share in the value created by economic activity, federal tax distribution may want to be reconsidered. Current competition between cities within Economic Development efforts is a result of local property tax structure, and location based income tax. Given the increasing multi-local existence for corporations, the multi-local existence for individuals, and including the declining home ownership statistics, there is reason to reconsider the way taxes are collected, and re appropriated. Below are a few suggestions:	X		X	+++	TTT	\$\$	\$\$\$	Similar to the sales tax conversation, currently occurring--there is major multi-state trade occurring and the local smaller companies are losing out to larger companies which have infrastructure to work within tax frameworks of multiple states.
2.1	Corporate: When jobs move, create temporary job revenue adjustment tax period to split flow of capital between places bridging, minimizing 'shock' to communities, and minimizing short term incentive plays for political gain								
2.2	Personal: Sign up to pay taxes federally and it gets automatically distributed to where you do business, minimizing the number of forms you have to fill out. Then you choose where to file business based on personal preferences, and what makes sense for the company.								
2.3	Municipal: Provide a level of 'shadow tax revenue' to gain tax income from other activities outside of place.								
2.4	Federal Grants should be able to be distributed across jurisdictions								
3.0	Implement a Multi-Municipal Cooperative Fiscal Pool Fund to provide scale by aggregating smaller city economies, even ones cross state lines, but ones that have 'affiliations' due to corporate locations and/or talent flows	X			++	TT	\$	\$\$\$	
3.1	In order to purchasing services together, across jurisdictions								
3.2	Share tech transfer expertise and facilitate entrepreneurs to be mobile								
3.3	CityShare: provide for expertise 'shared assets' between cities, like planning, economic, administrative, fiscal management								This is often seen in moments of crisis when expertise (law enforcement resources) are willingly shared.
3.4	Encourage grouping projects based on Connective Development strategies								

PORTALS

4.0	Facilitate and Support Creation of Place Consulates & Clubs to allow accessibility into the network of places--engaging diaspora, visitors, interested business development activities etc.	X X + T \$ \$	These do not need to be physical outposts, per se, but could be coordinated within other resources/venues
4.1	Providing platform/exchange venue for peer to peer advisory.		
4.2	Develop Resource Library & Talent Network Access		
4.3	Presentation venue capability: 'Hot jobs' broader opportunity base--'speakers corner' for available opportunities		
4.4	Facilitating convenient and increased meet ups of diaspora, professional networks and other communities that stretch between jurisdictions		
4.5	Support opportunities to expose populations between places to activities in other locations to better broaden educational and economic opportunities.		
4.6	Universities extension into new communities--portal for better navigation with local corporate expertise//talent for both faculty base and knowledge collaboration--easier than operating through government only.		
5.0	Provide Exchange Infrastructure to support Corporate need to have a better 'portal' into a variety of interesting places that they are already aligned with or might make sense for them for further development.	X X + T \$ \$	
5.1	Extending the corporate network into more communities--'smart' knowledge sourcing', and 'micro investment strategy' to help 'learning' by corporation. Via portal for efficiency,		
5.2	Exchange systems--like P&G connect and develop/innocentive model but through market strategy and curated content.		
5.3	Role for more brokering of assets between places (i.e. contract r&d and corporations/universities)		
5.4	Talent troll--market based on not availability but 'shared time'--talent for America program--10% of time to be dedicated to other activities		
6.0	Support and Initiate Enterprise Development Districts adjacent to intra-city transportation that provide for mixed uses from commercial to housing and industry--considering the market most likely to be mobile between places	X ++ T \$ \$	
6.1	Intracity development hubs (at train stations/airports)--support infrastructure for further commercial development		
6.2	Provide interface with multiple jurisdictional entities that benefit from the connectivity		
6.3	Consider alternative tax district structures (above) that provide benefits to locating in these districts		
6.4	Encourage the inclusion of Shared Asset Facilities to encourage more low-risk business development opportunities: tech shop, food incubators, housing options, fleet vehicles		
6.5	Explore incentives to develop talent pools in these districts (Shared Asset Talent--services)		
6.6	State level 'exchange' districts at airports--whereby there are some tax benefits to locate in these areas (like a state to state level 'free trade zone')		

PLACES IDENTITY

7.0	Entrepreneurial/Intrapreneurial Place Ambassadors best represent the spirit of the innovation economy. These individuals should be formally recognized as key influencers and illustrations of these networked cities.	X	X	+	T	\$	\$	\$
7.1	Creating public platform for 'influencers' with incentives							
7.2	Visibly recognizing 2 nd /3 rd time entrepreneurs & Successful spin offs							
7.3	Ribbon cuttings for people (great talent in your backyard)							
7.4	Welcome and Orientation services, and support networking visits to multiple places							
8.0	Leveraging Conference events to further boost innovation activity--Conferences further involvement into a place--hosting and repurposing spaces to use event as catalyst for new district growth., utilizing city for alumni activities rather than just campus.		X	+	T	\$	\$	\$
8.1	Repurposing Convention/Visitors Bureau to facilitate better utilization of city resources, leveraging additional resources to promote more long term relationships with place.							
8.2	Funds to help support & bring additional events/individuals during conference periods							
8.3	Provide services to further support conference planning/engagement with local corporations							
9.0	Marketing Place: District Development Differentiation efforts to better reflect distinction & role of place in larger economy		X	++	T	\$	\$	\$
9.1	Mixed Use including Live Work Make							
9.2	Made in' efforts/ Licensing 'PLACE' and core things							
9.3	Use regulatory zoning activity as a way to facilitate visibility of Enterprise Districts per above--provide supportive uses in zoning plans--federal incentive like TOD, but more along enterprise support							

CURRENCIES

10.0	Multi-City efforts to help catalyze ' Opening Doors ' and Providing Resources, Exposure		X	+	T	\$	\$	\$
10.1	Convening cross-organizational activities (i.e. tech transfer)							
10.2	Externships / Educational Exchanges (Programmatic & Financial)							Like DC allows for State School tuition anywhere for all local students
10.3	Open labs day, open labs for visiting researchers,							
10.4	Dorms reutilized for startup housing in a place							
10.5	friends of institution' program							
10.6	Corporations access to municipalities globall							
11.0	Encourage the prioritization of ' Quality of Life ' initiatives as Currency		X	+	T	\$	\$	\$
11.1	Affordability							
11.2	Access to a place (social network & ambassadors)							
11.3	Consistent Gov't transparency/efficiency of services/best value							
11.4	Travel subsidies to make more face to face meetings possible?							
11.5	History & Identity							
12.0	Recognition of other Federal Tax Discounts/Deductions for personal and corporate spend that are fuels to the innovation economy		X		++	T	\$	\$
12.1	Maintain & grow R&D tax credit, extending to personal filings							
12.2	Airline Miles / Use of Public Transportation							
12.3	Use of Shared Asset Facilities (encouraging efficiency)							
12.4	Invstments in infrastructure funds, or other Multi-City Investment Pools							
12.5	VC tax credits to locate in more places							
13.0	Place Patents' Development incentive--in the federal interest that would catalyze districts in productive places--an overlay from the state investment policy (which might be more politically motivated). Invest in federally important areas where federal dollars are distributed for R&D		X	++	T	\$	\$	\$
13.1	Corporations will support places and activities if they get direct benefits (redistribution of their dollars from tax to direct benefit)--write off as localized 'r&d'?							
13.2	Supported sabbaticals for industry resources to come to a place							
13.3	Fed programs to help foster state to stae anc city to city collaborations along R&D							

METRICS VISIBILITY

14.0	Measuring Direct Networked Productivity for visibility, education on what makes the economy work, and how people can further engage in the innovation economy	X	+	T	\$	\$	\$	
14.1	Local Registration/Asset Based Accounting							
14.2	Count the 'Creative Economy' Self-Employed in Labor Counts							
14.3	Count the super commuters							
14.4	Count the 'shadow' economy of people coming to a place regularly (training centers etc)							
14.5	Influence sheds (frames mindset of place)—hyper 'per capita' calculations							
14.6	Registry of some sort (resident card?)—multi-locational pass?							
14.7	introduce catalyst patent structure (open exchange/protectable/licensable on a much smaller way—more like a domain registry.							
15.0	Create new metrics for 'success' in economy—less place based and supportive of the key themes	X	X	X	++	T	\$	\$
15.1	University & Private TT efforts (coordinate with public)							
15.2	Financing							
15.3	R&D Transfer Markets							
15.4	Contracts etc. (new registry service? consultanttransaction.com?) Freelance contracts, meaningful contracts, tradeshow transactions, locational engagement, increase in transportation bookings between cities, Leasing contracts? Xerox or other scanners? What is a company transaction? Customers? Bibliometrics Registry (articles & PR?)							

REBALANCING

16.0	Tax distribution to Metropolitan economies, not to specific towns/cities (jersey city example).	X		++	T	\$	\$	
16.1	Measures to track capacity building (productivity?)							
16.2	Measure linkages as relevance (linked in for corporations)							
16.3	Locational engagement metrics—places likely to support innovation. Cellphone data showing patterns of movement.							
16.4	Focusing data on sub-industry clustering (talent) which moves, and therefore aggregate city 'cluster' of industries							
17.0	Formal Federal Recognition of the Innovation Economy	X		+	T	\$	\$	
17.1	New Office of Innovation Network, Talent & Mobility							
17.2	Multi-Locational Recognize connectivity & trends at US Census							
17.3	Revise NASICS Codes for Simplicity & Nuance							
17.4	Shadow taxes to gain tax income from other activities outside of place.							
18.0	Technology solutions to provide better visibility and ability to rebalance economy within policy frameworks.	X	X	X	++	T	\$	\$
18.1	CityXray: Augmented reality							
18.2	Citynavigator							
18.3	meme: connecting groups and discovering new places							
18.4	Engagement quotient and engagement of diaspora							

VIII. CONCLUSION | A Way Forward

It is a remarkable moment in time. Throughout writing of this document it appeared that everything in the popular press to scholarly journals seemed to be coming to the same realization. Truly transformative economic trends are in the process of shaping our future -- natural disasters & recovery, political upheaval & continental economic restructurings, demographic shifts, and a more mobile & connected culture than ever before. Certainly, this emerging 'zeitgeist' may have more to do with this author's foray into writing a document this comprehensive, but also speaks to a growing hunger to rethink our systems, and consider what can really work to boost the economy, given the tools at our fingertips.

As described in the 'methodology' section of this document, this analysis was intended as a broad survey of the current innovation economic landscape in order to provide a specific set of strategies that governments, corporations, and institutions could employ. The strategies proposed in the last section are by no means final, comprehensive or static, but indications of a way of thinking as we approach economic development moving forwards.

The Call for a Multi-Locational Network Infrastructure

However, from the analysis in this document, it has become clear to the author that there may still be a missing connective tissue to fully execute activities in line with the thesis. Recognizing the network structure of our economy, and understanding the need for local supportive environments is not enough.

Therefore, there is a need for a new 'meso-scale' infrastructure, one that sits between the Local, and Federal/Global governance models—more in line with the multi-locational activity in which people and corporate networks operate. Even if infrastructure is created 'virtually' through a more engaged network of existing organizations, led by like-minded individuals in those organizations, the connectivity across localized jurisdictions seems to be more and more vital to growing the economy. A fully operational agent, or 'agency,' that navigates these two realms is critical. A multi-city framework could help aggregate economies where economies of scale might count, or help provide necessary navigation to more places when a 'direct fit' might be necessary for a corporation, person, or program.

Certainly, two critical things are required for a multi-city framework to exist and be successful—First, it needs to be an entity that can both be a part of one community and a connector to other communities. A meso-scale agency needs to be able to drop in and connect with the local key influencers—the individual champions in those organizations that recognize their critical role within the localized economies, and they have the desire to implement change. Second, the meso-scale entity must bring expertise and resources, adding value to the localized efforts, while bringing additional value to the overall economy by connecting different localities. There needs to be a careful calibration of what is local, what is the connective tissue, and what is the overall economy that the agency is trying to accelerate.

Finally, and most importantly, this process to better knit together the armature of the innovation economy will take time—it will evolve. This author is committed to participating in and helping shape the next era of progressive development of the innovation economy.

VIII. BIBLIOGRAPHY

Adler, Ben. *Nextcity Daily: A Year One Report Card for Obamas Strong Cities Strong Communities*. 2013. <http://nextcity.org/daily/entry/a-year-one-report-card-for-obamas-strong-cities-strong-communities> (accessed 2013).

Agranoff, Robert; McGuire, Michael. "Multinetwork Management: Collaboration and the Hollow State in Local Economic Policy." *Journal of Public Administration Research & Theory* (Public Management Research Association) 8, no. 1 (January 1998): 67-91.

American Association of Advancing Science, "Programs: Science and Policy, Guide to R&D Funding: R&D at Colleges and Universities" on AAAS website (August 2008). <http://www.aaas.org/spp/rd/> (Science 2008)

American University Technology Managers (AUTM). *Transaction Survey FY 2009*. Annual Report, AUTM, AUTM, 2009.

Audretsch, David B and Feldman, Maryann P. "Knowledge Spillovers and the Geography of Innovation." *Paris: Cities & Geography*. Toronto: Indiana University and the Center for Economic Policy Research, University of Toronto, 2002.

Audretsch, David B, Dennis P Leyden, and Albert N. Link. "Regional Appropriation of University based knowledge and technology for Economic Development." *Economic Development Quarterly* (Economic Development Quarterly) 27, no. 56 (January 2013): 56-61.

Aulet, Bill, and Fiona Murray. "A Tale of Two Entrepreneurs: Understanding the Difference in the Types of Entrepreneurship in the Economy." Unpublished Draft, January 2012.

Avinmelech, Gil, and Maryann P Feldman. "The Impact of Institution Quality, Cluster Strength and TLO Licensing Capacity on the Rate of Academic Staff Spin Offs." *Atlanta Conference on Science & Technology Policy*. Atlanta, 2011.

Badger, Emily. *How the End of the Traditional Workplace is Changing Our Cities*. April 19, 2013. <http://www.theatlanticcities.com/neighborhoods/2013/04/how-end-traditional-workplaces-will-change-cities-around-them/5343/>.

Beauchesne, Olivier H, and Eric Archambault. "Scale-Free Geographical Mapping of Scientific Collaboration of MSA's." *45th Annual Meeting*. Cleveland, 2011.

Beauchesne, Olivier H, "Map of scientific collaboration between researchers" on Authhor's Blog. January 23 2011. <http://olihb.com/2011/01/23/map-of-scientific-collaboration-between-researchers/>

Bettencourt, Luis M A, José Lobo, Dirk Helbing, Christian Kühnert, and Geoffrey B. West. "Growth Innovation Scaling and the Pace of Life in Cities." Edited by Elinor Ostrom. *Proceedings of the National Association of Sciences of the United States of America* (National Academy of Sciences) 104, no. 17 (2007): 7301-7306.

Bruner, Jon, Forbes Special Report Interactive Map on Migration in Forbes Online (2011) <http://www.forbes.com/special-report/2011/migration.html>

Cain, Susan. *Quiet*. New York: Random House, 2012.

College of Nanoscale Science and Engineering-Albany. *College of Nanoscale Science and Engineering Homepage*. <http://cnse.albany.edu/AboutUs.aspx>.

Conway, Steve, and Fred Steward. "Mapping Innovation Networks." *International Journal of Innovation Management* 2, no. 2 (1998): 223-254.

Cooke, Phil. "Bioregions: Knowledge Domains, Capabilities and Innovation System Networks,." *Industry and Innovation* (Routledge) 13, no. 4 (2006): 437-458.

Dishman, Lydia. *Fast Company*. January 2015, 2013. <http://www.fastcompany.com/3004788/future-coworking-and-why-it-will-give-your-business-huge-edge>.

Dobbs, Richard, Sven Smit, Jaana Remes, James Manyika, Charles Roxburgh, and Alejandra Restrepo. "Urban World Mapping the Economic Power of Cities, McKinsey Global Institute Report." *McKinsey Insights & Publications*. McKinsey Global Institute. 2012. http://www.mckinsey.com/insights/mgi/research/urbanization/urban_world.

Dos, Yves, Jose Santos, and Peter Williamson. *From Global to Metanational: How Companies Win in the Knowledge Economy*. Boston, MA: Harvard Business School Press, 2001.

Draper Laboratory. *Draper Laboratory Profile*. 5 9, 2013. <http://www.draper.com/profile>.

Dreyfuss, Rochelle Cooper. "Double or Nothing: technology transfer under the Bayh-Dole Act." In *Business Innovation and the Law: Perspectives from Intellectual Property, Labour, Competition and Corporate Law*, edited by Ann Monotti, and John Duns Marilyn Pittard, 52-73. Edward Elgar Publishing Ltd, , 2011.

Economic Development Administration. *Annual Report to Congress*. Annual Report, Economic Development Administration, Washington DC: United States Government, 2011.

Etzkowitz, Henry. "Research Groups as Quasi-Firms: The Invention of the Entrepreneurial University." *Research Policy* 32, no. 1 (2003): 109-121.

Farrell, Mike. *The Kendall Squeeze*. <http://www.tech.mit.edu/V132/N18/kendallsqueeze.html>.

Feld, Brad. *Feld Thoughts Blog : Government and Universities Should Use the Word 'Convener' More*. August 30, 2012. <http://www.feld.com/wp/archives/2012/08/government-and-universities-should-use-the-word-convener-more.html>.

—. *Startup Communities: Building an Entrepreneurial Ecosystem in Your City*. New York, NY: Wiley, 2012.

Feldman, Maryann P. "The Entrepreneurial Event Revisited: Firm Formation in a Regional Context." *Industrial and Corporate Change* 10, no. 4 (2001).

Feldman, Maryann, and Johanna Francis. "Homegrown Solutions: Fostering Cluster Formation." *Economic Development Quarterly* 18, no. 2 (May 2004): 127-137.

Feldman, Maryann, and Maryellen Kelley. "The Ex Ante Assessment of Knowledge Spillovers: Government R&D Policy, Economic Incentives and private firm behavior." *Research Policy* (Science Direct) 35 (2006): 1509-1521.

Feldman, Maryann, Meric Gertler, and David Wolfe. "University Technology Transfer and National Systems of Innovation: Intro to Special Issue on Industry & Innovation ." *Industry and Innovation* 13, no. 4 (2006): 359-370.

Florida, Richard. *The Atlantic Cities Jobs and Economy: The Uselessness of Economic Development Incentives*. December 7, 2012. <http://www.theatlanticcities.com/jobs-and-economy/2012/12/uselessness-economic-development-incentives/4081/>.

—. "The Atlantic: Business." *The Atlantic*. September 10, 2010. <http://www.theatlantic.com/business/archive/2010/09/the-density-of-innovation/62576/>.

Florida, Richard. "The Role of the University: Leveraging Talent not Technology; Issues in Science and Technology." *Issues in Science and Technology* (National Academy of Sciences) 15, no. 4 (1999): 67-73.

Glaeser, Edward. *Triumph of the City*. New York, NY: The Penguin Press, 2011.

Glaeser, Edward, and William Kerr. *Harvard Business Review Archive: The Secret to Job Growth, Think Small*. July 2010. <http://hbr.org/2010/07/the-secret-to-job-growth-think-small/ar/1>.

Gompers, Pal, and Josh Lerner. *Harvard Business School Working Knowledge: The Determinants of Corporate Venture Capital*. November 6, 2000. <http://hbswk.hbs.edu/item/1763.html>.

Green, Jeff. *Bloomberg Businessweek: Super Commuters Take the Morning Plane*. February 23, 2012. <http://www.businessweek.com/printer/articles/10300-super-commuters-take-the-morning-plane>.

Green, Joshua, and Caroline Winter. *Bloomberg Businessweek/It Costs 333 Million to Shut Down Boston For a Day*. April 19, 2013. <http://www.businessweek.com/articles/2013-04-19/it-costs-333-million-to-shut-down-boston-for-a-day#r=read>.

Harmon, Brian, A. Ardishvili, R. Cardozo, T., Leuthold, J. Elder, J. Parshall, and M Raghian. "Mapping the University Technology Transfer Process, University of Minnesota." *Journal of Business Venturing* 12, no. 6 (1997): 423-434.

Henderson, Jeffrey, Peter Dicken, Martin Hess, Neil Coe, and Henry Wai-Chung Yeung. "Global Production Networks and the Analysis of Economic Development." *Review of International Political Economy* (Routledge) 9, no. 3 (August 2002): 436-464.

Huston, Larry, and Nabil Sakkab. "Connect and Develop: Inside Proctor & Gamble's New Model for Innovation." *Harvard Business Review*, March 2006.

Kedrosky, Paul ("Migration in America, Vibrant Flux" in Forbes, online, November 16 2011. <http://www.forbes.com/special-report/2011/migration.html>

Kotkin, Joel. *New Geography Blog: Numbers Don't Support Migration Exodus to Cool Cities*. November 3, 2009. <http://www.newgeography.com/content/001153-numbers-dont-support-migration-exodus-cool-cities>.

—. *New Geography Blog: Small Cities are Becoming a New engine of Economic Growth*. May 8, 2012. <http://www.newgeography.com/content/002817-small-cities-are-becoming-a-new-engine-of-economic-growth>.

Krugman, Paul. "What's New About the New Economic Geography." *Oxford Review of Economic Policy* 14, no. 2 (1998): 7-17.

Kuang, Cliff. *Infographic of the Day*. <http://www.fastcodesign.com/1664973/infographic-of-the-day-does-innovation-flow-from-cities>.

Linderman, Matt. *Signals & Noise: "Where 37 Signals Employees Livework"*. September 8, 2009. <http://37signals.com/svn/posts/1894-a-map-of-where-37signals-employees-livework-larger-version>.

Locke, Richard. "Building Trust." Unpublished, 2012.

Ludwig, Adam, and Adrienne Burke. *Techonomy: GeE-Quirky Deal Opens Patents to Almost Everybody*. April 10, 2013. <http://techonomy.com/2013/04/ge-quirky-deal-opens-tech-patents-to-almost-everybody/>.

Malone, Thomas W. *The Future of Work How the New Order of Business Will Shape Your Organization, Your Management Style, and Your Life*. Boston, MA: Harvard Business School Press, 2004.

Mission and History. <http://www.sister-cities.org/mission-and-history> (accessed February 2013). MIT . *MIT Press Release: Rededication to Martin Trust Center for Entrepreneurship*. November 2011. <http://web.mit.edu/press/2011/trust-center-dedicated.html>.

Murphy, Samantha. *Facebook Mobile Developer Conference Coming to 3 Global Cities*. <http://mashable.com>.

Murray, Fiona, and Scott Stern. "Do Formal Intellectual Property Rights Hinder the Free Flow of Scientific Knowledge?" *Journal of Economic Behavior and Organization* (National Bureau of Economic Research) 63, no. 4 (2006): 648-667.

Newman, M.E.J. "Coauthorship networks and patterns of scientific collaboration." *Proceedings of the National Academy of Sciences*. 2004. 5200-5205.

Ostrom, Elinor. *Project Syndicate Commentary: Green From the Grassroots*. June 12, 2012. <http://www.project-syndicate.org/commentary/green-from-the-grassroots>.

Pagliery, Jose. *Money.CNN.Com/Small Business*. November 27, 2012. <http://money.cnn.com/gallery/smallbusiness/2012/11/27/startup-cities/index.html>.

Porter, Michael E. "The Competitive Advantage of Nations." *Harvard Business Review*, March 1990.

Porter, Michael, and Mark Kramer. "Creating Shared Value." *Harvard Business Review*, January 2012.

Powers, Joshua B. "R&D Funding Sources and University Tech Transfer: What is Stimulating Universities to be More Entrepreneurial." *Research in Higher Education* 45, no. 1 (February 2004): 1-23.

PWC. "PWC Cities of Opportunity 2012." *Price Waterhouse Coopers*. 2012. <http://www.pwc.com/us/en/cities-of-opportunity/2012/pdf-download.jhtml>.

Rallet, Alain, and Andre Torre. "Temporary Geographical Proximity for Business and Work Coordination :when, how, and where?" *Spatial Aspects Concerning Economic Structures*. 2 (2009).

Rallet, Alain, Torre, Andre. "On Geography and Technology: Proximity Relations in Localized Innovations Networks." Edited by M Steiner. *Clusters and Regional Specialization* (Pion), 1998.

Rodrigo Nigrinis, Andrew. "Where Did Industrial R&D Labs Locate? The Inter War Years." (Stanford University).

Saxenian, Anna Lee. "Inside Out: Regional Networks and Industrial Adaptation in Silicon Valley and Route 128." *Cityscape: A Journal of Policy Development and Research* (US Dept Housing and Urban Development) 2, no. 2 (May 1996): 41-60.

Shoham, Shani, "The Complete Guide to Incubators" on Shani's Business Review Blog, September 11, 2011 <http://shanishoham.wordpress.com/2011/09/11/guide-to-incubators/>

Shrestha, Manik, and Marco Marini. "Quarterly GDP Revisions in G20 Countries: Evidence from the 2008 Financial Crisis, ." *IMF Working Paper*. International Monetary Fund, March 2013.

Small Business Administration. *Small Business Administration Office of Advocacy, FAQ: Small Business*. September 2012. http://www.sba.gov/sites/default/files/FAQ_Sept_2012.pdf.

Small Business Labs, "Coworking Boom Continues" on Small Business Labs Blog, <http://www.smallbizlabs.com/2013/03/coworking-boom-continues.html>

Sung, Albert. *Seeking Alpha: US Government Invents New Way of Calculating GDP*. April 24, 2013. <http://seekingalpha.com/article/1368001-u-s-government-invents-new-way-of-calculating-gdp>.

The Boston Globe. *Boston Globe Editorial: Open Boston How Freer Civic Cultural Life Helps Region Retain Innovators*. 25, 2013. <http://www.bostonglobe.com/editorials/2013/02/25/open-boston-how-freer-civic-cultural-life-helps-region-retain-innovators/mqoKS1BCFEkPdQgmoQhtrL/story.html>.

The Economist. *Arrested Development: America and Europe are relying on private firms in the global R&D race*. August 25, 2012. <http://www.economist.com/node/21560863>.
—. "Has the Ideas Machine Broken Down." *The Economist*, June 12, 2012: 21-24.

The White House. *White House Blog*. April 25, 2013. <http://www.whitehouse.gov/blog/2013/04/25/supporting-local-communities-building-capacity-and-cutting-red-tape>.

U.S. National Science Foundation, *Science and Engineering Indicators 2012*, Chapter 4. R&D: National Trends and International Comparisons. <http://www.nsf.gov/statistics/seind12/c4/c4s1.htm>

VanRoekel, Steven. *White House Blog: Roadmap for a Digital Governemnt*. May 23, 2012. <http://www.whitehouse.gov/blog/2012/05/23/roadmap-digital-government>.

Vilasenor, John. *Brookings Institution Opinion*. March 13, 2013. <http://www.brookings.edu/research/opinions/2013/03/13-patent-reform-villasenor>.

Washington Biz Journal . *Washington Biz Journal Blog: SBA Changes Rules with respect to R&D/SBIR & STT* . December 2012. http://www.bizjournals.com/washington/blog/fedbiz_daily/2012/12/firms-sound-off-on-new-rule-allowing.html?ana=&page=all.

West, Darell. "Brookings Institution Research: Improving University Technology Transfer & Commercialization." *Brookings Institution*. December 2012. <http://www.brookings.edu/~media/research/files/papers/2012/12/05%20tech%20transfer%20west/darrelluniversity%20tech%20transfer.pdf>.

Wikipedia. *Wikipedia/Battelle Memorial Institute*. May 9, 2013. http://en.wikipedia.org/wiki/Battelle_Memorial_Institute.

Lectures

Professor Clayton Christensen (Special Lectures for Sloan Fellows 3/4-3/6 & 3/12 2013)
Vikram Pandit (Former CEO Citigroup, Media Ventures Visit March 2013)
Robin Chase (Former CEO ZipCar, Media Ventures Visit May 2013)

Informational Conversations

- Lisa Amini, IBM Smarter Cities Dublin, 12.12.12
- Chuck Andraka, Sandia National Labs, January 2013
- Phil Bernstein, AutoDesk, Director of Industry Strategy, 1.18.13
- Doug Burger, Director Cloud at Microsoft Research, 1.30.13,
- Seth Stephens Davidovitz, Google/Harvard PhD, 3.19.13
- Tim Ferguson, Ron Walker, Next Street (Merchant Bank/E.D. Advisory) 3.12.13
- Professor Edward Glaeser, Harvard University 2.27.13
- Professor Calestous Juma, Harvard University
- Tom Kelly, White House Council...3.15.13
- Rob Larson, Dave O'Dowd, Melinda XXX(legal counsel), Draper Lab 12.3.13
- Professor David Lazer, Northeastern University, 4.10.13
- Dan Lurie, Director of Strategic Partnerships, NEA 2.8.13
- Seth Pinsky, NYCEDC President, 4.15.13
- Valerie Piper, Assistant Secretary for Economic Development, Housing and Urban Development, 3.4.13
- Thomas Pounds, Former Battelle Employee, 12.11.13
- John W. Puziss, Ph.D. Director of Technology Licensing, Office of Cooperative Research, Yale University School of Medicine, Interview with OCR, 2.22.13
- Jonathan Rothwell, Researcher, Brookings Institution. 2.22.13
- Bonnie Shaw: Digital & Ecosystem convener, Research on Innovation Labs, 3.7.13
- Jason Shupach; Design Director of NEA (Former Mass E.D.), 2.22.13
- Frank Serna, Draper Lab 1.15.13
- Bruce Winschell, Business Development & Lawyer, Tech Ventures Inc 3.25.13
- Giorgos Zacharia, Kayak, 2012
- Jack Hughes, Chairman, Top Coder, April 2013

WEBSITES

Mashable.com

Inc.com

Fastcompany.com

<http://www.cofounderslab.com>

<http://www.angellist.com>

<http://www.battelle.org>

<http://www.draper.com>

<http://www.sandia.com>

<http://research.microsoft.com/en-us/>

<http://www.techshop.ws/locations.html>

http://en.wikipedia.org/wiki/Bayh-Dole_Act

<http://www.sister-cities.org/mission-and-history>

<http://www.federallabs.org/home/faqs/>

<http://startupweekend.org>

EDA.gov

SBA.gov

Whitehouse.gov

NIST.gov

Census.gov

AUTM.org

Brookings.edu

HUD.gov

McKinsey Global 600 Cities Data/map

http://www.mckinseyquarterly.com/Cities_the_next_frontier_for_global_growth_2758?pagenum=1#interactive

Author Note: Every attempt has been made to document and cite all materials used during this research project.