
**THE ROLE OF INNOVATION BROKERS
IN A KNOWLEDGE ECONOMY
THE FOURTH STRAND TO TRIPLE HELIX**

Prepared by
Collaborative Economics



Submitted to
Triple Helix XI International Conference
London, July 2013

Collaborative Economics, Inc. | www.coecon.com

Collaborative Economics works with senior executives from business, foundations, government, education and community sectors - helping them create breakthroughs in how people think and act regarding their region. Collaborative Economics' clients have the passion, vision and commitment to blaze a new pathway for their community. They understand that a new kind of leadership is required to create great places, with thriving economies and world-class quality of life.

About the authors:

Jessie Oettinger - As Project Manager at Collaborative Economics, Jessie is part of the technical assistance teams for U.S. Department of GJIF and ARRA High Growth and Emerging Industry grants, providing technical assistance regularly for U.S. DOL green jobs grantees across the country.

Doug Henton - As Chairman and CEO of Collaborative Economics, Doug has more than 30 years of experience in economic and community development at the national, regional, state, and local levels. Doug is nationally recognized for his work in bringing industry, government, education, research, and community leaders together around specific collaborative projects to improve regional competitiveness.

Collaborative Economics 520 S. El Camino Real, Suite 710 San Mateo, CA 94022 P | 650.235.8323

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[MOVING TOWARDS A KNOWLEDGE ECONOMY]

Coming out of an unparalleled global recession much thought has been given to the United States’ changing economic reality. For decades the United States has been losing ground to emerging economies when competing on the cost of labor or natural resources, yet has continued to excel as a world leader in the area of technology and other knowledge-based industries. Capitalizing on national strengths like a regulatory, academic, and cultural history of supporting innovation and innovators, many suggest that the way to maintain global competitiveness is by shifting from an industrial economy to a knowledge economy.

Innovation economics reformulates conventional economic theory so that knowledge, technology, entrepreneurship, and innovation are positioned at

the center of a new growth model rather than seen as independent forces that are largely unaffected by policy. Innovation economics is based on two fundamental tenets: that the central goal of economic policy should be to spur higher productivity through greater innovation, and that markets relying on input resources and price signals alone will not always be as effective in spurring higher productivity, and thereby economic growth. In the following paper we will use the term “innovation economy” to describe this new economic model.

If communities are to keep pace with a rapidly changing global marketplace, regions are tasked with supporting or in some cases creating an innovation economy.

Table 1
Ideas Drive Economic Growth

| | INDUSTRIAL ECONOMY | INNOVATION ECONOMY |
|-----------------------|--|---|
| RAW MATERIALS | Natural Resources, Labor, Capital | Ideas |
| CUSTOMER FOCUS | Mass Production | Mass customization based on information technology and product design |
| ORGANIZATION | Large Corporation, Economies on Scale | Entrepreneurs, Small Scale, Free Agents, Networks |
| SUCCESS FACTOR | Labor, Quantity, Low Cost Stability, Control | Talent, Speed, Innovation Flexibility, Customization |

[CAPITALIZING ON KNOWLEDGE: THE TRIPLE HELIX MODEL]

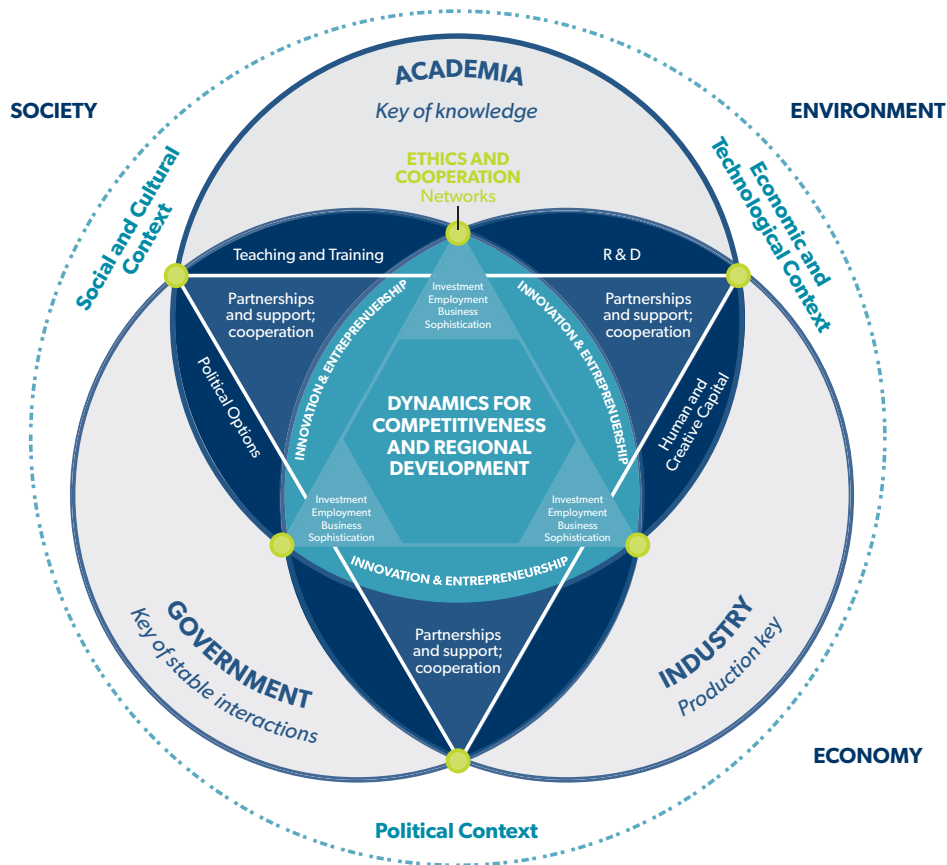
The Triple Helix “is a model for capitalizing knowledge in order to pursue innovation.”¹ Knowledge, particularly the kind generated at universities and national labs, and the processes, networks and resources that transform it into useful, commercializeable innovation are at the heart of the Triple Helix model: the powerful combination of Academia, Industry, and Government. The premise of the Triple Helix model is that these three entities can and should work together to make sure ideas and knowledge generated in research institutions (many of them publicly funded) end up in the marketplace and drive innovation.

To capitalize on the knowledge of universities and national labs, Academia needs to take responsibility

not just for educating and creating knowledge, but for seeing that knowledge is put to use. Industry in turn must view academia as an important partner and source of knowledge, worthy of capital and human resource investment. Government has an important role to play in funding research and operating a regulatory environment that incentivises innovation and expedites relevant dispersion of important knowledge. The Helix’s three strands paint a poignant image, evocative of DNA and the double helix that is the basis of life, but when Farinha and Ferreira model the Triple Helix as part of resilient regional economy we start to see a more complex picture.

The actions taking place in this model show the larger

Figure 1
Farinha and Ferreira’s Triple Helix Triangulation model²



¹ (Etzkowitz 2010)

² (Farinha and Ferreira 2013)

picture of what it really means regionally to connect academia, industry, and government. The variety of tasks and services required to go beyond the commercialization of federally funded research to an entire regional economy driven by innovation from all sectors is immense. In their report for the National Science Foundation, “Unraveling the Cultural and Social Dynamics of Regional Innovation Systems”, Walshok, Shapiro, and Owens state that:

Intermediary organizations are an essential component to the process of innovations. . . because entrepreneurial science and technology enterprises tap in to multiple forms of knowledge, beyond basic science to be successful. . . As such interdisciplinary, cross-functional organizations are critical to the knowledge flow, the expertise and the trust building which enable innovation and risk-taking.³

For this reason we suggest a fourth “strand” be introduced to the Helix: the Broker entity that ties it all together. Whether the Broker is a single person or an institution, the efficient connection of all of this information lowers transactional costs and barriers to entry. The Innovation Broker is an important actor in an innovation economy because they take raw regional assets like universities, local industry, and sources of capital and connect them in order to create new businesses, jobs, and wealth. This paper describes the role of the Innovation Broker and other innovation economy actors and captures early promising practices in effective Broker activities.

[THE FOURTH STRAND: INNOVATION BROKERS]

In 2008, Collaborative Economics (CoEcon) published the “Innovation Driven Economic Development Model.” The paper outlines why innovation is important for regional development, how regional development relationships and existing social infrastructure might support innovation, and features a series of case studies on regions that created a regional infrastructure that supports innovators and innovative companies. The outcome of investing in such infrastructure allows the region’s innovation economy to grow by reinforcing the bonds, networks, and resources to promote the successful commercialization of ideas and research.⁴

To describe this infrastructure and the networks that connect people and businesses to resources CoEcon has used the term “Innovation Broker”; the actor who “intervene[s] at appropriate times to help firms achieve higher value and productivity by gaining access to appropriate innovation assets at each stage of the business development process- startup, expansion, production and marketing.” Figure 2 shows how businesses and entrepreneurs connect to the Innovation Broker in order to interface with the many other resources

in the community. Innovation Brokers serve as the hub of an important network of businesses, capital, and people. They connect entrepreneurs and businesses to services such as help writing Small Business Innovation Research (SBIR) applications, intellectual property (IP) analysis, and early stage capital. Through this brokerage, the company is efficiently connected with necessary services to grow its business which generates jobs, wages, and regional wealth. The system is reinforced by what flows from new and improved businesses (more capital for investment, more companies, more ideas) and attracts more investment and talent from other places.

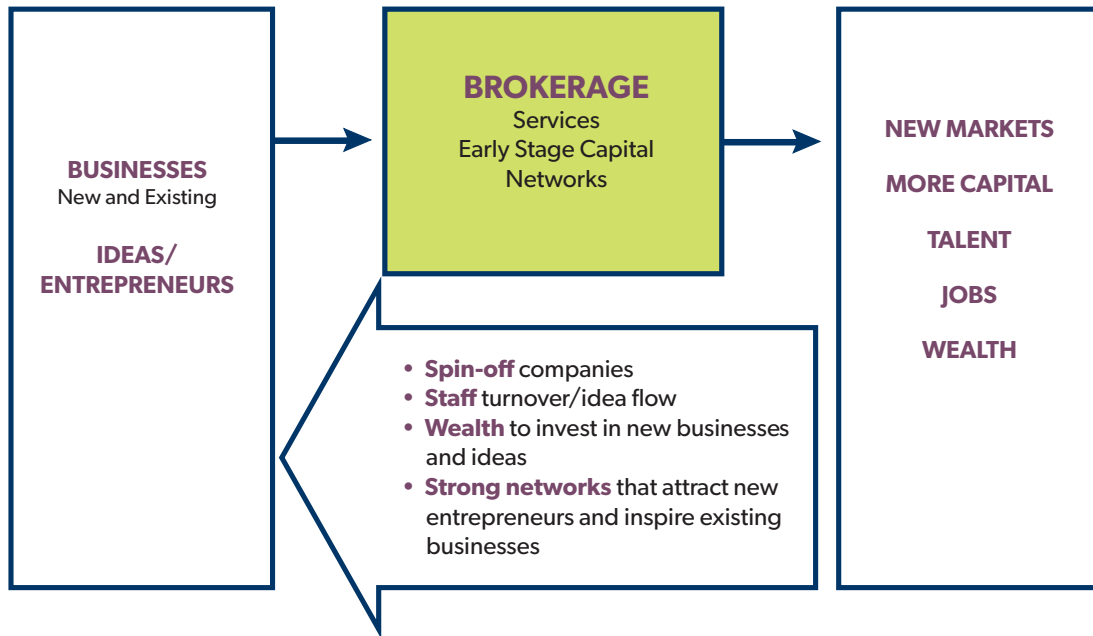
The Broker builds a regional financial, tactical, and social infrastructure to support innovators. What is special about an innovation economy as shown in this model is that it is perpetually reinforced by the cyclical nature of investing in and supporting innovation. New markets, new talent, and increased capital created by this cycle attract high quality talent to the region and spin out new companies, new ideas, and more capital to reinvest in other forms of innovation.

³ (Walshok, Shapiro and Owens 2013)

⁴ (Collaborative Economics 2008)

Figure 2

The Innovation Broker connects businesses and entrepreneurs to community resources, creating a virtuous cycle



The Broker In The Innovation Economy

An innovation economy supports its businesses and entrepreneurs by fostering a network of open idea flow, capital and services aimed at helping companies innovate and get ideas off the ground. As described in the Figure 2, the system strengthens itself with each iteration. In this sense the Broker is also the centripetal force that binds and enforces the innovation economy and strengthens the region's ability to attract talent, capital, and ideas.

In this vision of the innovation economy business is central to all other activities. The networks, services, and capital are directed towards (and exist in service of) businesses and entrepreneurs. Holding the innovation economy together is the Innovation Broker. All of these services, people, ideas, and capital might exist in a regional economy but the Broker accelerates, facilitates and supports the connection of these entities ensuring better access to information and resources. The Broker can be an official entity like an accelerator, tech transfer office, or economic development office: a place for entrepreneurs to go when they need advice, capital, and support. Or it can be more informal: a network of people who have

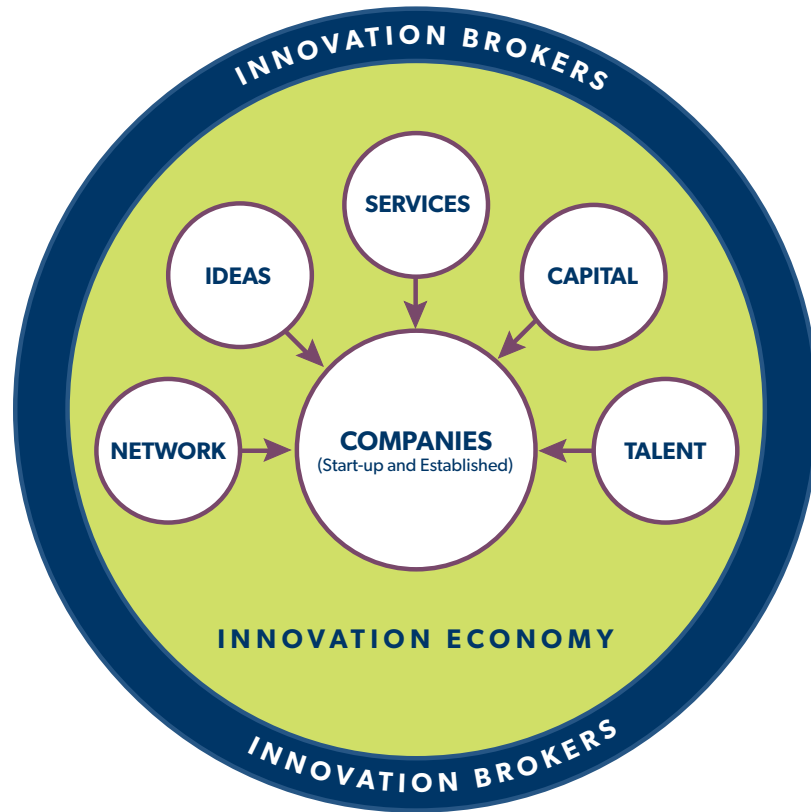
knowledge of resources, are willing to share, and see the importance of facilitating the free flow of information in an innovation economy.

Many mistakenly believe that the innovation economy is limited to startups, but an important part of the Broker model is that it provides services for existing entities as well as startups. Good commercializable ideas don't just spin out new businesses: they can improve existing businesses by making them more competitive.

In the past several decades many regions and organizations have undertaken the task of defining, designing, and implementing infrastructure that supports local innovation with the hope that these projects will create well-paying jobs, regional wealth, and social capital. In this paper we will focus on the kinds of Broker-entities that regions have proactively created to accelerate the growth of innovative businesses. These entities often provide services that may not yet be available in the regional economy and even more importantly they provide a platform for entrepreneurs and business owners to access to the innovation assets in a community.

Figure 3

Brokers as the centripetal force that directs regional resources toward business



CREATING AND SUPPORTING INNOVATION ECONOMIES: THE ROLE OF DIFFERENT ACTORS IN AN INNOVATION ECONOMY

Innovation economies have the potential to transform regional economies and there have been many attempts to analyze and breakdown what makes a regional innovation economy work. In an analysis of Silicon Valley (arguably the most powerful innovation economy in the world) Lee, Miller, Hancock, and Rowen breakdown the “Silicon Valley Habitat,” describing ten characteristics of the Valley that make it so successful in driving innovation.⁵ The attributes—Knowledge intensity; High skill and mobile workforce; High quality life style; Universities and research institutions that interact with industry; Open business environment; Results oriented meritocracy; Climate that rewards risk and tolerates failure; Collaboration among business; government and nonprofit organizations; Specialized business infrastructure, Favorable rules of the game—point to clear roles for the actors in the Triple Helix as well as Brokers and other supporting organizations. However, what is important about all of the characteristics of the habitat is that no one characteristic is owned or maintained by a single player; government, academia, industry, and the Broker all have an important role to play in building the knowledge community, creating an innovation culture, developing strong networks, and advocating for programs, policies, and action on the federal, state, and regional level that support regional innovation and global competitiveness.

Building the knowledge community

(Knowledge intensity, high skill and mobile workforce, high quality life style)

If knowledge and ideas are at the heart of the innovation economy, clearly the people with the actual ideas (and the institutions that house them) are a key ingredient in an innovation economy. Universities, research institutions, industry and local governments are all part of recruiting and retaining a high skill knowledge community. Some aspects of this task are quite obvious and self-serving, like that universities and local firms should attempt to bring high quality individuals with the capacity for innovation to the region. But it is the role of all the actors in the innovation economy to ensure that these individuals want to stay and contribute to the regional economy.

Local firms and research organizations can work closely with universities and economic development agencies to make sure that talent is coming in and staying: that there are jobs for graduates or resources for them to start their own businesses locally. Local firms can ensure that they continue to offer competitive salaries, benefits, and working conditions that encourage people to stay and grow. Governments and all tax payers are responsible for ensuring that other quality of life elements are in place such as pleasant public spaces, attentive local government, and good public schools, to name a few.

Creating an innovation culture

(Universities and research institutions that interact with industry, Open business environment, Results oriented meritocracy, Climate that rewards risk and tolerates failure; Specialized business infrastructure)

Innovation habitats prepare researchers and university students to think of their work as having application in the real world. Without discounting the importance of “pure” research, applied research is gaining traction in institutions all over the world. Universities and research institutions must do their part to encourage faculty and staff to think about how their work applies to the real world.

Education and industry also have a very particular role in creating environments where individuals are encouraged and rewarded for thoughtful risk taking. An important part of Silicon Valley culture is that individuals and companies that take risks that don’t pan out are not branded as failures or stigmatized indefinitely for unsuccessful ventures. This is not to say that all ventures have equal risk or that being respectful of human and financial capital is not important, rather that it is the responsibility of larger institutions to calculate and balance risk taking so as to allow room for innovation.

Another part of innovation culture is the Lee et al.’s “open business environment.” Companies in Silicon Valley compete with each other but they also share knowledge which has led to better performance by all companies. This approach to knowledge helps all the companies in the region further cutting edge research.

⁵ (Lee, et al. 2000)

Communities with thriving innovation economies produce demand for specialized business services. These specialized services can be aimed specifically at entrepreneurs like intellectual property (IP) attorneys, venture capital firms, or head hunting services, or they can be specific to the innovation sector like data centers or wet labs. Our survey of innovation economies revealed that mature innovation economies have a private sector that naturally produces this important element of an innovation economy but that in many emerging innovation economies these services are provided by government, nonprofit, or philanthropic sources looking to jump start the local market. Often the Broker is the entity responsible for overseeing the provision of these services.

Developing and fostering a network

(Collaboration among business, government and nonprofit organizations)

In many communities it is the role of the Innovation Broker to bring relevant stakeholders to the table, to develop and drive regional competitiveness plans, and to make connections. Brokers, familiar with all entities, promote collaboration and make thoughtful, appropriate connections. It is the role of all the actors in the innovation economy to fully participate, to send decision makers to collaborative efforts, and to work with other members of the network in good faith.

Advocating for policies and practices that support innovation

(Favorable rules of the game)

Lee et al. describe the American regulatory system as being one of the most innovation-friendly in the world. What makes the market work, in terms of the regulatory system according to William Baumol, is that there are laws enforcing intellectual property which creates incentives (monetary, recognition) for inventors to invent. These IP laws are complemented with a set regulatory processes that allow inventors to buy, sell, license and trade their technology. However, despite comparative friendliness on a global scale there are some aspects of a capitalist, free-market economy that work against innovation.⁶ It can be challenging for emerging markets to strike the balance of incentivizing innovators to invent, ensuring that technology is then shared for the benefit of the

larger industry, protecting the intellectual property of inventors and firms, and thus finding appropriate levels and mechanisms for licensing fees. There can also be bad actors in an innovation economy, a place where the social capital created by a thriving innovation habitat can be very helpful.

Government clearly plays an important role in creating and enforcing a regulatory system that supports innovation, but academia, industry and Brokers can advocate for other kinds of policies that specifically affect the innovation habitat. As Congress and the Administration take an increasing interest in innovation, all entities must be prepared to lobby on behalf of innovation-central policies, such as research funding, immigration issues, education reform, and patent reform.

Innovation economies are not limited to traditional high tech hubs like Seattle, Boston, and Silicon Valley; they are emerging all over the country as economic development agencies, universities, private companies, and governments recognize the importance of investing in innovation.⁷ On a national scale the recognition of innovation as a means of achieving prosperity and the support for smaller, regionally driven innovation investment are starting to show exciting results.⁸ But how can individual regions capitalize on this movement? What actions should regions take to support innovation economies? The task of spurring innovation from an economic development perspective is creation and support of infrastructure⁹ both tangible and intangible that supports innovation. To facilitate and catalyze these efforts a region needs all the actors in the “quadruple helix;” the Ideas, the Industry, Government and of course, Innovation Brokers.

⁶ (Baumol 2002)

⁷ (Muro 2013)

⁸ (The Accelerators 2013)

⁹ (Collaborative Economics 2013)

[SUPPORTING INNOVATION: ACTIONS, TOOLS, ORGANIZATIONS]

Regions everywhere are thinking about how they too can capitalize on local knowledge and encourage entrepreneurial activities. Some communities are just getting started: identifying innovation assets, bringing together local leaders from industry, academia, and government and crafting economic development plant that focus on innovation. For these communities the role of the Broker may be particularly important as Brokers often serve early on as the entity convenes local stakeholders, drives the action planning, and provides important business services specific to innovation.

There are also very mature innovation economies like Silicon Valley or Boston: places where innovation has been part of the local economy for decades. In places like this, with a more developed innovation economy there are significant differences. Certain inputs to the system like capital or business services are their own sector: driven by the demand from healthy innovation based businesses. For instance, there are over 300,000 employees in Silicon Valley's Information Products & Services industries which includes software and internet services, but there are an additional 150,000 plus employees in Innovation & Specialized Services including technical R&D, legal, marketing and design as well as 50,000 in administrative services and business support.⁹

As the promising practices section below will describe, having specialized services and capital are crucial for propelling an innovation economy. In places where these assets are not in abundance, Innovation Brokers have been known to step in as intermediaries.

Still other communities are somewhere in between, moving from a model where the government or philanthropy was the largest driver of innovation services, to a model that includes an equally invested private sector.

There are not clear definitions of or pathways from early to intermediate to advanced innovation economies, but there are a number of tools for supporting innovation economies and helping communities advance an innovation strategy. Below we will describe a number of entities that promote and advance innovation in their regions. These groups run the continuum from economic development projects, to public or philanthropically funded venture capital organizations, to groups of local stakeholders interested in innovation. Their actions are similar in many ways, but they also reflect the diversity of what each regional economy needs in order to make innovation grow.

[PROMISING PRACTICES IN INNOVATION ACTIVITIES]

Innovation Brokers are the brokers in a network of ideas, capital, services, and talent. For the purposes of this early promising practices work, we surveyed the work of approximately twenty Innovation Brokers. Six of these organizations (Technology 2020, i2E, Innovation Works, North Dakota Center for Innovation, TechColumbus, Ben Franklin Technology Partners of Southeastern Pennsylvania) have been featured on the Regional Innovation Acceleration Network (RIAN) website as examples of successful innovation infrastructure. We also spoke to NorTech of Northeastern Ohio, Accelerate Long Island, San Diego CONNECT, the International Center for Water Technology, Innovate St. Louis, and a number of Washington State institutions, both public and private.

All of the organizations that were interviewed or researched for this publication placed a high value on the importance of bringing stakeholders together, driving actionable plans, and connecting the parts of the innovation economy in meaningful ways that improved the efficiency and efficacy of the whole system. Brokers and other innovation entities in many cases also filled in the gaps between what the innovation economy needed specifically business services and capital and what was currently available. Especially in economies transitioning to supporting innovation, where basic innovation assets like venture capital, local law firms specializing IP law, or business incubators were in short supply, it was particularly important for the Brokers to play the role of service provider as well as supporter and connector.

Creating, supporting, and driving the innovation network

The most obvious inputs to an innovation economy are ideas, workforce, and capital, but to effectively utilize and synthesize these innovation inputs strong, thoughtful leadership and collaboration are key. A network that facilitates the efficient connection of people, services, ideas, and capital greatly improves outcomes. Creating active, collaborative networks that work together to realize shared goals is no small task. Including the right people and having a realistic and actionable plan to drive regional innovation are crucial to effectively utilizing innovation assets.

Strong collaborative leadership

The Innovation Broker leadership team needs to be comprised of entrepreneurs and innovation experts as well as established regional leaders who have the credibility, connections, and resources to aid implementation. All of the organizations surveyed for this paper asserted that strong, collaborative leadership was crucial to moving these organizations forward. More specifically, leadership needs to be comprised of decision-makers who don't just advocate for innovation infrastructure within their organizations but actually deliver on action steps. For example, in St. Louis the mayor, the head of the Chamber of Commerce, and the Chancellor of Washington University were all part of the leadership group that set out to make St. Louis a hub for the Life Sciences Industry. In Fresno, the International Center for Water Technology had important advocates from industry, local government, and California State University who helped find funding and drive the mutually beneficial venture forward.

In "Unraveling the Cultural and Social Dynamics of Regional Innovation Systems" Walshok, et al. find that the characteristics of the region, technology, industrial legacy, and leadership team have significant impact on efficacy of Innovation Brokers. Important takeaways are that the Innovation Broker must be entrepreneur-focused (as opposed to simply business focused); that the leadership team must include researchers, scientists, and entrepreneurs; and that staffing and leadership must have directly relevant skills and competencies to help innovators commercialize their ideas.¹⁰ This finding was affirmed by the University of Washington's Center for Commercialization who stated that their effectiveness increased when they hired a serial entrepreneur to head the organization. Her specific knowledge of and experience in shepherding ideas through to actual products has helped the team serve more clients and with greater success.

Another important quality of Innovation Broker leadership is that it should be driven by and have a strong presence of private sector representatives. Governments and

economic development organizations can play an important role in innovation, but sustainable efforts must come from the entities that directly benefit from such collaboration and networking. Government can be an excellent partner in this process: addressing regulatory issues, providing funding and support for the processes that lead to strong relationships, and by serving as "advocates for the deal." There was general consensus among interviewees that governments should not be "picking winners and losers" or actively trying to plan or shape markets, but the work of economic development does require strong channels of communication and response from state and local government.

Mission/Strong business model

When asked about what drove the success of their International Center for Water Technology, President David Zoldoske said that a strong business plan, built collaboratively, was key. The plan focused on three discrete tasks which were assigned to small groups. Each group set out to accomplish their piece of the work and after completing these tasks the team re-evaluated and re-wrote their business plan to include a new set of goals. In St. Louis, a study commissioned at the beginning stages of their planning laid out specific targets to enable the city to attract large Life Sciences corporations. This plan, drafted in 2000, has served as a roadmap; it represents the shared mission of the entire leadership team and allows them to move forward together, despite their varied sectors.

Creating an actionable plan with the right group of people is not the same for every community. Depending on the technology, industrial legacy and geographic landscape, embedded social and cultural dynamics, and material capital assets different kinds of strategies will need to be formulated. Over two decades ago with the end of the Cold War, San Diego needed to fill the gap in their economy that defense contract spending had previously driven. The local university and a handful of entrepreneurs, IP lawyers, and scientists got together and formed San Diego CONNECT. CONNECT's leadership did not include (at the outset) politicians, major philanthropists, or representation from large companies, but it was the right group of people to drive innovation and the supporting innovation infrastructure in San Diego. In contrast, in St. Louis, which was a major industrial city at the beginning of the 20th century, the effort to reinvent their city as a destination for Life Sciences companies necessarily involved the participation of major civic leaders such as the mayor, head of the chamber of commerce, and a member of a major philanthropic family. The cultural and industrial histories of these two cities are different and resulted in different approaches to building innovation infrastructure.

¹⁰ (Walshok, Shapiro and Owens 2013)

Filling in the Gaps: Specialized Services and Capital

Two key components of a healthy innovation ecosystem are specialized services for innovators and access to capital. For communities lacking in either area an important role that the Innovation Broker can play is to provide these specialized services and to connect businesses and startups with various forms of early-stage capital. These two key activities work hand-in-hand to assist companies and individuals with innovative ideas to secure financial and tactical support.

Services

The kind of services offered by Brokers is dependent on what is needed locally to serve innovators. For the most part, this services section will focus on Brokers who have early stage or intermediate stage innovation economies, where service provision is still an important Broker function. Below is a beginning list of services that an Innovation Broker might offer. It's important to remember that this is just a brief overview of the kinds of services organizations Brokers provide. The way individual communities tailor these models to best serve regional needs is crucial to their success.

Business services for entrepreneurs

Almost every Broker we spoke with actively provided business services for innovators. Services included: business plan creation/review; intellectual property (IP)/legal consulting; business viability consulting (domain specific, commercialization potential, business development); headhunting for executive management; and SBIR grant application assistance. Innovation Brokers had various ways of providing these services. Some used law students and MBA students to provide business plan assistance or IP review. Others employed professionals, either through a referral/contract basis, or had these individuals on staff. Regardless of who provided the services and how much they cost, the most important take-away was that staff who deliver these services must be qualified. This is a challenge that any new Innovation Broker should not take lightly.

Technology transfer

For regions with strong research assets (federal labs, large research universities), helping scientists bring an idea to market is an important service. For example, Tech2020's Center for Entrepreneurial Growth (CEG) is a resource for any University of Tennessee or Oakridge National Lab researcher. Employees of these organizations can access CEG's business services and pathways to capital as part of an agreement between Tech2020, University of Tennessee and Oakridge/Battelle labs. Similarly, Innovation Works in Pittsburgh has special grants for university researchers who want to take their research from basic (usually federally funded) to applied (more

difficult to find funding). The University of Washington's Center for Commercialization connects researchers with Entrepreneurs in Residence and also offers a post-doc in commercialization for PhD students who want to commercialize their dissertation research. It is important to note that one of the most difficult aspects of technology transfer is recognizing a commercialize-able idea within the kind of research conducted at a lot of these facilities. Researchers are not necessarily entrepreneurial thinkers and may not be able to recognize what in their "pure" research has marketable value. Because this kind of thinking is rare, effective tech transfer offices both help researchers take their products to market and help them find applicable purposes by supporting activities like Entrepreneur in Residence.

Entrepreneur in Residence (EIR)

At Washington State University the EIR program connects interested entrepreneurs with University researchers. The entrepreneur helps the department/researcher commercialize research by providing strategic, startup-specific, experiential knowledge. This often involves starting at the very beginning: figuring out what shape the research will take as a marketable item. EIRs work as both mentors and business partners to take research from its earliest stages all the way to market. Oklahoma's main Innovation Broker, Innovation to Enterprise (i2E, Inc.), also connects EIRs to startups but the program is less intensive. An EIR (who may or may not be located in the state) flies in for a week to work with the startup and then stays in touch through weekly phone calls to help coach the startup through the various stages of growth and decision-making.

Physical infrastructure: Labs, office space, IT

St. Louis recognized its potential to be an influential life sciences hub, but understood that it lacked the kind of lab space needed to develop pharmaceuticals. The city built special wet laboratories where chemicals, drugs and other biological matter can be handled. Innovation Works in Pittsburgh offers researchers/innovators access to (partner) university labs to help solve problems that require the use of expensive equipment. Many of the Brokers we spoke with offered incubator or office park space to fledgling companies. These incubator spaces usually charge below-market rent, offer opportunities for innovative businesses to work next to each other, and include some degree of administrative and IT infrastructure. Tech2020 opened its region's first data center in 2001 to provide IT infrastructure for the entire region: the data center was an economic development/infrastructure project and it served to help Tech2020's clients.

Networking events

All of the organizations in this study provide opportunities for entrepreneurs, startups, and investors to network with each other. Different organizations host conferences, networking events, educational activities, and even awards ceremonies.

Community resources

With limited resources and reach, several Innovation Brokers have launched initiatives to extend their resources to the wider community. Pittsburgh's Innovation Works is not able to incubate and mentor every business or startup that comes to its door, but it has tried to make resources publicly available through its [Entrepreneurs Toolkit blog](#). The blog includes a series of articles covering important topics for entrepreneurs such as business models, compensation, corporate governance, deals, founders' issues, fundraising, management and marketing and sales. North Dakota's Center for Innovation employs a different approach to extending their reach in the community by managing a venture competition, "Innovate North Dakota". This competition is unique because anyone (from North Dakota or willing to relocate to North Dakota) can enter. The competition takes nine months and includes an entrepreneurial education curriculum and several boot camps along the way. In the end, twenty finalists pitch to ten angels, who determine five winners.

Programs for existing businesses

Innovation infrastructure resources appear to be largely directed at entrepreneurs and startups despite the fact that the majority of new jobs comes from existing business. However, there are several exceptions in this sample of Innovation Brokers. Innovation Works in Pittsburgh, PA has a program that connects small manufacturing businesses with regional Centers for Excellence to provide fee-for-service R&D that assist the companies in developing new products and better manufacturing processes. While the program charges companies for the R&D consulting work, companies can win match grants from the Innovation Adoption Grant Fund for up to \$50,000. The Center for Innovation in North Dakota manages a USDA rural outreach grant that supports businesses in rural communities. The Center for Innovation works with these businesses through a virtual client coach and relies on local economic development commission partners to help with in-person consulting. In Cleveland, NorTech works with its anchor companies to introduce them to local research and innovators that might help them improve their competitiveness. In some ways existing businesses need many of the same supports

that startups do: capital, the right partners, and IT/IP services. But existing businesses face challenges that start-ups do not (and have resources that start-ups do not) so it is important to work with local companies and assess their particular innovation needs.

The Innovation Broker lens can be limited to helping researchers commercialize and sell their ideas to entrepreneurs to be launched as startups, but this kind of thinking limits sources of R&D, capital, and commercialization. In the past important investment in research and innovation was much more prevalent in the private sector. The last few decades have seen a shift away from this practice which has left some holes in the innovation landscape for existing companies¹¹ that perhaps could be filled by Innovation Brokers. Strategic investment by existing firms in new (extra-organization) research and innovation assistance for existing firms are two strategies that need to be further explored.

Early-stage capital

In this section we will talk about different ways that Brokers provide startups with access to early-stage funding. It is important to note that the funding is always tied to a package of services that include strong mentorship and business support from Broker staff. Capital is another instance where the maturity of the innovation economy is an important factor. In younger innovation economies, venture capital and investment is often provided using public or philanthropic dollars. As innovation economies move along the continuum from early to advanced, the role of the broker changes from providing capital, to providing connections to the community's private capital.

Funding provided by the Innovation Broker

A key element of a Broker in fledging innovation economies is providing early-stage, pre-venture (even pre-angel) funding for startups. Many Brokers began as technology transfer offices and understand very well that many of the nation's most valuable R&D assets are not always readily evident or ready for market. Some Brokers differentiate more micro stages of gap funding, breaking early-stage funding into even more categories. For example, TechColumbus has a "Tech Genesis Fund" that employs a "fail fast" methodology. Participants are given up to \$25,000 to quickly research whether or not their research is actually commercialize-able. TechColumbus follows the process closely and at the first sign that the idea may not make it all the way, the operation is shut down. Ben Franklin Technology Collaborative (BFTC) of Southeast Pennsylvania supplies both loans and

investments depending on the stage of the innovation. BFTC offers large (\$100,000-\$750,000) investments to more mature startups and smaller direct loans for earlier stage companies for things like proof of concept, scalable prototypes, and field research. Other funds will offer capital to startups along the continuum of early-stage funding: proof of concept all the way to venture funding.

There are also a variety of funding models for the dispersal of early-stage capital. Some Brokers provide unsecured loans, others convertible notes, and others a mix of both. Most organizations prefer a convertible debt model which can allow for creativity and flexibility based on the organization, its risk profile, and the local market for capital.

Funding provided through connections within the Broker

Another means for financial support that an Innovation Broker can supply is access to Angel investors. Some Brokers serve as clearing houses for Angel stakeholders who rely on connections with the Innovation Broker to introduce them to promising startups. In some cases

Angels are actively involved in reviewing Innovation Broker funding applications and provide either sidecar financing to the ventures the Innovation Broker funds or separate funding to companies the Innovation Broker elects not to support. In Philadelphia, the Ben Franklin Technology Collaborative of South East PA rigorously screens applications to determine which applicants will become a portfolio company. Even if the applicant does not receive funding and services from BFTC at the end of the process they are often able to connect with other investors and mentors who saw their ideas during the screening process.

TechColumbus manages several "bands of Angels" or funds of pooled Angel money. While the Angel leadership makes choices about who to invest in, the staff at the Broker manages the day-to-day operations of the fund and make sure investments/entrepreneurs are well supported. The Angels will often co-invest with other TechColumbus ventures.

[FUNDING FOR INNOVATION ACTION]

Like startups, Brokers often require their own early-stage financing to get started. The organizations in this paper had significant funding from state, federal or philanthropic sources.

State support

Oklahoma and Ohio are examples of two states that invested heavily in creating innovation infrastructure support. Both states sought to strengthen their economies through diversification away from traditional industries, oil and gas (OK) and manufacturing (OH). The states invested significantly in startups and innovation by seeding the risk capital funds that the Brokers deploy. In 2005, Ohio's Third Frontier program invested \$15 million in TechColumbus to get it off the ground and has provided follow-on funding since. In Oklahoma, there is a dearth of both early and late-stage venture capital so the state has been largely responsible for funding i2E's two main venture funds that have dispersed over \$10 million. Until 2008, 90 percent of i2E's funding came from the state, but today it is closer to 60 percent. In both of these cases, the state was both the instigator and the major funder of the Innovation Broker.

Philanthropic support

The Center for Innovation at University of North Dakota was funded largely through alumni donations. The university granted \$20,000 to start the Center, but the rest of the capital came from 15 individuals who wanted to invest in the state and promote innovation and entrepreneurship at the university level. Today, roughly a quarter of the Center's operating budget comes from donations. In St. Louis, the leadership group of civic, educational, public and private sector leaders working to transform St Louis relied heavily on in-kind time investment of their leadership group, but were also supported by a local champion, Chancellor Emeritus of Washington University, William Danforth, who put the support of his family foundation behind the effort.

Federal support

When Oakridge National Laboratory management shifted from the government to Battelle Labs and the University of Tennessee the region wanted to ensure that the research generated at the lab was commercialized, leading to new businesses and good paying jobs. Using a combination of donations from the private sector, such as Bell South and

Lockheed Martin, and the U.S. government, Tech2020, a regional Innovation Broker focused on commercializing Oakridge National Lab research was born. Since its establishment in 1995, a significant source of revenue to support investment in new businesses has been federal grants through the USDA and the Small Business Administration.

Self-sustaining activities

From its inception, the leadership of Tech2020 was focused on becoming self-sufficient and not reliant on federal or state grants to help with operating costs. Other Brokers such as the International Center for Water Technology and San Diego CONNECT also sought diverse funding sources. Examples of revenue generating operations include:

- **Incubator space:** Tech2020 owns or operates seven incubators in the region. Rent revenues cover facility maintenance.
- **Stake in venture funds:** As mentioned in the previous section, Tech2020 was successful in applying for federal SBA grants that led to the creation of community investment funds. While Tech2020 manages the staff of one of the ventures, it has spun its four funds out to be independent ventures. However, the organization still has a stake in all of these ventures funds and the revenue generated from these community loan programs is another source of funding. The advantage to having been investing in local businesses for almost 20 years is that many early investments and funds are starting to create a real source of revenue.
- **Fee-for-service consulting:** The services that Tech2020 makes available to University of Tennessee and Oakridge Lab researchers are also available to the general public, but the organization charges fees for its business/startup consulting services. Recognized regionally as an excellent source for startup services, the Center for

Entrepreneurial Growth has an impressive team of consultants. They credit tireless recruitment for the best employees and finding extra dollars to pay competitive salaries crucial to being able to charge for their services.

- **Data center:** In 2001, Tech2020 started a data center to meet unmet IT infrastructure demand. Over the last decade, the data center, the oldest in the region, has grown substantially. After being spun out to be its own company, Tech2020 sold its controlling interest in the firm last year. They are now hoping to use the proceeds from that and the revenue from their investment stakes to create an endowment as another source of operating revenue.
- **Services valued by industry:** the International Center for Water Technology (ICWT) offers 3rd party testing for water technologies. The center has an excellent reputation for quality testing and its position gives it a way to earn money and stay connected with industry trends.
- **Member dues:** San Diego CONNECT charges (sliding scale) dues to its members. Belonging to the CONNECT network has value to participating entities and CONNECT members show that value by paying to be part of the organization.

None of these sources of revenue are mutually exclusive and to a degree, all of the organizations we spoke with had some amount of support from the private, public, and philanthropic sectors. The age of the organization was also important in understanding its funding model. Older organizations have had enough time to see their venture capital begin to pay off. Younger organizations who have also invested in emerging companies have not yet had time to recoup their investments. What is clear is that significant early funding (along with good leadership and a sound business plan) was key to getting these organizations off the ground and on the path to sustainability.

[MEASURING SUCCESS]

The most popular metrics for evaluating the success of innovation infrastructure projects are likely the result of economic development underpinnings; most Innovation Brokers have at least attempted to capture the dollar value of their investment in innovation. Common metrics include: follow-on funding and investments that were realized in companies due to early-stage investment by the Innovation Broker; actual dividends, interest payments, successful exits, etc. paid back to the Innovation Broker due to a portfolio company's success; the wages and revenues from new jobs and businesses, and the associated tax revenues collected by these activities. However, measuring only these outcomes, especially at an early stage of Brokerage can be frustrating and not tell a complete story. Many of these quantifiable economic benefits take time to make clear gains. However, Innovation Brokers should not use this as a reason not to collect these data points and instill a institutional culture of rigorous self evaluation.

Viewing Brokerage purely through an economic development lens can lead to missing other important outcomes. The Innovation Broker must consider what other valuable outcomes they believe their institution can provide to the community.

- **Community and network building:** Some Brokers measure the number of events that take place, the attendance, etc. Others measure the number of "touches" they had to local businesses and entrepreneurs: how many people came in seeking services or connection? San Diego CONNECT uses their member dues as a measure of how valuable members find CONNECT's services.
- **Innovation inputs:** SBIR awards and other research/grant dollars are real cash assets coming into a community and express the confidence in/ strength of the innovation landscape.

- **Innovation outputs:** Outputs like patent registrations or licensing might be good examples.
- **High quality workforce:** Has investment in local educational institutions and business impacted the demographics of an area? Keeping track of in and out migration, educational attainment, and other demographics will allow communities to measure their diversity, competitiveness, and other important human resource measures.

The above metrics are assets that have a direct connection to innovation, but to be a true innovation economy, a region must be attracting people, businesses, and capital and creating a "buzz." While Brokers cannot claim directly causal relationships, other important metrics a Broker might want to collect surround quality of life: things like rates of volunteerism, voter turnout, and the development or attraction of other community amenities such as parks, museums, and college campuses.

Metrics are important and accountability is essential when investing public (and private) dollars, and Innovation Brokers must be thoughtful about what they choose to capture. As one Broker put it, "what you measure is what you get." Brokers should attempt to capture the impact they make on the larger community for several reasons. Data that shows how Broker intervention positively impacts the ability of a region to attract, retain, and capitalize on knowledge gives the Broker credibility to attract stakeholders and thus more resources for the entire community. Relatedly, data can also help Brokers raise funds to cover their operating costs. Whether the funds are coming from the public, private or philanthropic sector, investors want to know how their money is being used to further public and economic benefit. Finally, good evaluation data provides strategic self assessment opportunities. Innovation Brokers have a responsibility to their community, their funders and themselves to gather good evaluation data.

[INNOVATION BROKERS ARE ESSENTIAL TO CAPITALIZING KNOWLEDGE AND DRIVING AN INNOVATION ECONOMY]

The Triple Helix lays out a framework for regions to effectively capitalize on the knowledge generated by academic pursuits by bringing together Academia, Industry, and Government. Together these entities form a strong asset base for an economy grounded in knowledge and innovation. However, we believe innovation economies function most efficiently and effectively when there are people and organizations in place to facilitate and catalyze the activities that take ideas and knowledge and shepherd them through to a marketable product. As such we suggest that the Innovation Broker, the entity that integrates the activities of the actors in the Triple Helix, is a crucial part of the DNA for knowledge based, innovation economy.

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