Driving Regional Growth in the United States

The Changing Role of Federal and State Policies to Promote Clusters

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Abstract

Recognizing the importance of innovation-based economic growth, many state and local governments across the United States are attempting to create innovation clusters. These are regional concentrations of large and small companies that develop creative products and services, often in collaboration with specialized suppliers, service providers, universities, and research organizations. In addition to educating and attracting a critical mass of skills and talent, many states and localities are seeking to promote increased interaction among entrepreneurs, researchers, and innovators. To this end, they are investing in science parks, business incubators to nurture start-ups, and an array of research collaborations between universities and private industry.

The federal government has traditionally played an important if largely supportive role in the development of regional innovation clusters in the United States. This role is now evolving. This paper reviews some recent state initiatives as well as changes in the federal role in assisting and accelerating the growth of regional innovation clusters.

Introduction

Governments around the world have recognized the powerful competitive advantages of strong regional innovation clusters.[1] Strengthened by an improved understanding recognition of how clusters merge and develop,[2] local, regional and national governments around the world are

[1] For a review of current trends in the globalization of innovation and the nature of locational competition, see Barry Jaruzelski and Kevin Dehoff, "Beyond Borders: The Global Innovation 1000, *Strategy and Business*, Vol. 53, Winter 2008.

[2] In their review of the genesis of clusters, Feldman and Braunerhjelm note that "clusters are born and develop on the basis of specific combinations of capabilities, incentives, and opportunities." The presence of *capabilities*—including the presence of localized knowledge, a skilled workforce, and the availability of capital—creates *opportunities* for entrepreneurship and collaboration, where these opportunities can be realized in the presence of appropriate *incentives*. See Pontus Braunerhjelm and Maryann Feldman, *Cluster Genesis: Technology based Industrial Development.* Oxford: Oxford University Press, 2006. See also Maryann P. Feldman and Johanna L. Francis, "Homegrown Solutions: Fostering Cluster Formation." *Economic Development Quarterly*, Vol. 18, No. 2, May 2004.

implementing programs and policies to create, develop, and strengthen locally focused networks among businesses, universities, research and development organizations, and philanthropic foundations.[3] A recent study by the Brookings Institution documents national cluster development programs in Japan, the Republic of Korea, and 26 nations in the European Union.[4]

Unlike many Asian and European nations, however, the United States has not generally adopted explicit national policies that promote development of particular industries in specific regions.[5] Federally funded research and military procurement have played a vital, if indirect role in the emergence of clusters that have formed around major research universities.[6] Broadly based federal policies have also effectively stimulated cluster formation; through the Bayh-Dole Act of 1980, for example, Congress encouraged universities and national laboratories to commercialize federally funded research.[7] However, it has been up to state and local governments and, in some cases, private foundations and other regional organizations to stimulate the development and growth of clusters directly. In many cases, these state and local efforts lack critical mass in terms of funding and facilities and, in some cases, the sustained policy support needed for success.

To address this apparent gap and to adjust to the changing international competitive environment, some advocates have called for the federal government to play a more active role in supporting the development of local innovation clusters.[8] They have urged federal agencies to "link, leverage, and align" their resources with regional innovation cluster initiatives. The impetus for this change has also come from a National Academy of Sciences Report, *Rising Above the Gathering Storm*, which warned that the U.S. is in danger of ceding global leadership

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[3] Robert Lucas has long argued that the clustering and density of talented people is a key driver of innovation and economic growth. See Robert Lucas, "On the mechanics of economic development," *Journal of Monetary Economics* 22, 38-39. Richard Florida has popularized the characteristics and economic advantages of innovative clusters. See, for example, Richard Florida, *The Rise of the Creative Class*, New York: Basic Books, 2002.

[4] See Karen G. Mills, Elisabeth B. Reynolds, and Andrew Reamer, "Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies," Brookings Institution, April 2008.

[5] There are, of course, exceptions; for example, the Tennessee Valley Authority, which was created by an Act of Congress on May 18, 1933.

6 For an analysis of the military role in the origins of Silicon Valley and the high-tech industry in Boston, see Stuart W. Leslie, The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford, New York: Columbia University Press, 1993. Substantial federal funding for Stanford University has played a key role in the development of Silicon Valley. See Stephen B. Adams, "Growing where you are planted: Exogenous firms and the seeding of Silicon Valley," Research Policy Volume 40, Issue 3, April 2011, Pages 368-379

[7] The Bayh Dole Act of 1980 (PL 96-517, Patent and Trademark Act Amendments of 1980). permits the transfer of exclusive control over many government funded inventions to universities and businesses operating with federal contracts for the purpose of further development and commercialization.

[8] See, Karen G. Mills, Elisabeth B. Reynolds, and Andrew Reamer, "Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies," Metropolitan Policy Program at Brookings, April 2008. See also Ed Paisley and Jonathan Sallet, "The Geography of Innovation: The Federal Government and the Growth of Regional Innovation Clusters," Center for American Progress. 2009. See also Mark Muro and Bruce Katz, "The New 'Cluster Moment': How Regional Innovation Clusters can Foster the Next Economy." Washington DC: Brookings Institution Metropolitan Policy Program, September 2010.

in technology and innovation to nations with more ambitious and comprehensive policies to enhance their competitiveness (National Academy of Sciences et al. 2007). Citing this report, Congress in 2007 passed, and in 2010 reauthorized the America COMPETES Act, which included provisions to boost the development of innovation clusters.[9] The impetus for more focused development activity has also come in response to the recent economic downturn and its severe impact on manufacturing employment.

A New Role for Federal Policy

Drawing on these developments, and recognizing clusters as important catalysts for growth and employment, the Obama Administration has actively sought to develop federal-regional partnerships to foster their development. As we see next, key initiatives to develop regional innovation clusters are being led by the National Institute for Standards and Technology, the Department of Energy, and the Small Business Administration.

The National Network of Advanced Manufacturing Centers

Unveiled by President Obama on March 9, 2012, the National Network for Manufacturing Innovation (NNMI) will consist of up to fifteen dynamically linked regional clusters of manufacturing innovation. These institutes of manufacturing innovation, and the regional collaborations that they catalyze, are designed to tackle barriers to the rapid and efficient development and commercialization of new advanced product and manufacturing process innovations.[10] They are also designed to foster collaboration across U.S. research universities and other science and technology organizations to support the scale up of manufacturing and assembly processes.

Each institute is expected to leverage and expand the industrial, research, and institutional strengths of a region. The focus of each institute will be determined through a competitive application process that will be managed by a national program office. The leaders of the individual institutes, in turn, are expected to collaborate through a decentralized Network Leadership Council, which will oversee efforts to develop common and consistent approaches to issues such as intellectual property protection, evaluation and metrics, and the sharing of best practices in technology and knowledge transfer among institutes.

The federal contribution for NNMI is to consist of a one-time, one billion dollar investment over a five to seven year period. Each institute is expected to become financially independent within seven years. This catalytic support is contingent on co-investment by industry partners, state and local governments, and private foundations. To date, a pilot center— the Institute for Additive Manufacturing Innovation— was launched in August 2012 in

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[9] The America COMPETES Act (P.L. 110-69), enacted on Aug. 9, 2007, directed national laboratories owned by the Department of Energy to establish Discovery Science and Engineering Innovation Institutes to co-develop applications for technology with universities and industry. On January 4, 2011, President Obama signed the America COMPETES Reauthorization Act of 2010. However, as an 'authorization bill', "COMPETES will only have an impact to the extent that the funding levels it lays out are actually appropriated over the next three years." Eugene Reich, "US Congress passes strategic science bill," *Nature*, December 22, 2010.

[10] National Science and Technology Council, NNMI: A Preliminary Design, Washington DC: The White House, January 2013.

Youngstown, Ohio. It serves as a prototype, bringing together a broad coalition of over eighty companies, nine research universities, six community colleges, and eighteen not-for-profit organizations.

The Energy Department's Energy Regional Innovation Clusters

The Energy Regional Innovation Cluster (E-RIC) program is a new initiative led by the Department of Energy to develop regional clusters in solar power, energy-efficient buildings, nuclear energy, and advanced batteries for storing energy. The Energy Department has announced that the first regional innovation hub will focus on developing more energy efficient buildings, in recognition of the fact that buildings consume 40 percent of energy generated in the United States. This hub will also draw the participation of related industries such as appliance manufacturers, building supply manufacturers, and construction companies.[11]

E-RIC also expects to draw on support from other federal agencies in coordinating with an array of regional partners such as colleges, workforce training programs, private companies, non-government organizations, and local and state development agencies. Describing the scope of the initiative at a National Academy of Sciences symposium, Ginger Lew, then of the White House National Economic Council, noted that the Labor Department can team with community colleges to make sure a region has enough engineers and skilled workers to meet project demand for a cluster, the National Institute for Standards and Technology (NIST) can work with university-industry research centers to accelerate development of core technologies, and the SBA can provide seed capital for qualifying start-ups (Lew, 2012). While observing that getting so many federal bureaucracies to work together is a significant challenge, she noted that a major goal of the E-RIC initiative is to fine-tune the collaboration model so that it could eventually be used as a template to accelerate other federal efforts to support the development of regional innovation clusters (Lew, 2012). The costs in time and effort to coordinate these very diverse programs and procedures remain, nonetheless, a major constraint.

The EDA's Regional Innovation Strategies Initiative

The Economic Development Agency (EDA) at the Department of Commerce has launched a Regional Innovation Strategies Initiative, to provide a framework for its economic-development activities. In remarks at a National Academy of Sciences symposium, then EDA Administrator John Fernandez stated that his agency is realigning all its programs to support this initiative, adding that staff members are developing a rich database of innovation cluster activities across the country and new metrics to evaluate their performance (Fernandez, 2012). He noted that EDA programs also offer technical assistance and disseminate best practices to economic-development practitioners. For example, the agency offers an online, self-paced curriculum called "Know Your Region" that explains the benefits of regional planning, data on

[11] See Energy Department Website: http://energy.gov/articles/energy-efficient-building-systems-regional-innovation-cluster

employees and companies in each county that could contribute to a cluster, and tools to formulate regional strategies.[12]

Finally, EDA is expanding the scope of its public works program to include critical infrastructure needs of the 21st century, such as research parks, incubators, and better access to capital. Assistant Secretary Fernandez also reported that the EDA is supporting proof-of-concept and workforce training centers that are custom-designed to act as catalysts for specific technology clusters and to serve the needs of communities (Fernandez, 2012).

NIST's Nanoelectronics Research Initiative

The Rapid Innovation and Competitiveness initiative, launched in 2007 by the National Institute of Standards and Technology (NIST), seeks to increase the nation's return on its scientific investment through the development of innovation clusters. Its first pilot program, the Nanoelectronics Research Initiative (NRI) draws together industry, government, and academia to work toward the development of semiconductor technologies that eventually will replace CMOS.[13]

NIST relies heavily on industry input to define technology roadmaps for next-generation semiconductors. The alliance includes corporations such as IBM, Advanced Micron Devices, Freescale, Micron Technology, and Texas Instruments, as well as 35 universities.

Under the NRI initiative, four nanotechnology research centers have been set up at different universities around the country. The largest, an 11-university consortium called Index, is based at the State University of New York-Albany. Other centers are located at the University of Texas-Austin, the University of California-Los Angeles, and Notre Dame University. NIST contributes $2.75 million annually to the centers.[14] Given the importance of the semiconductor industry to U.S. growth and competitiveness, one wonders if more robust funding would be in order.[15]

These efforts are however, in many cases, being complemented by investments by state governments. NIST's initial investments in the Albany cluster, for example, are dwarfed by those of the state of New York, which has provided grants, tax breaks and other subsidies of more than $1 billion to encourage big-company investments and foster the birth of small start-ups in the Albany cluster (Haldar, 2011).

The Small Business Administration's Support for Clusters

The Small Business Administration (SBA) is broadening its traditional role of providing advice, loan guarantees, and grants to small businesses to provide support for clustered

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[12] Access at http://www.knowyourregion.org/

[13] See NIST, "NIST, SRC-NRI Enter Partnership to Drive Search for Next-Generation Computer Technology" September 13, 2007.

[14] NIST-CNST –At a Glance. Access at http://www.nist.gov/cnst/upload/CNST_2008_report.pdf

[15] For an empirical analysis of the significant positive impact of semiconductor based technologies on U.S. productivity growth, see Dale W. Jorgenson, Mun, S. Ho, and Kevin J. Stiroh, *Productivity, Information Technology and he American Growth Resurgence*, Cambridge MA: MIT Press, 2005

development.[16] According to SBA Administrator Karen Mills, the agency has a $90 million loan portfolio, 68 field offices, and 900 Small Business Development Centers across the nation that can be harnessed to support the growth of clusters across the nation. The SBA also is affiliated with SCORE, a small-business mentoring program with 350 chapters and 14,000 counselors (Mills, 2011).

SBA's efforts to foster regional clusters began with the Michigan robotics cluster. According to Karen Mills, the agency saw an opportunity to help struggling automotive suppliers meet the Department of Defense's need for unmanned military vehicles for use in detecting roadside bombs. The Detroit area's advantages include an advanced manufacturing supply base, automated tool suppliers, expertise in sensor technologies, and robotics R&D at Oakland University. SBA helped organize a two-day meeting of Department of Defense procurement officers and 200 Michigan businesses.[17] SBA also is helping organize similar cluster initiatives in Hampton Roads, Virginia (in robotics, unmanned systems, port security, sensors, modeling, and simulation) and in Hawai'i (to develop unmanned vehicles to detonate unexploded ordinance.) The SBA expects to fund additional clusters in robotics and other technologies around the country.[18]

Additional Federal-State Synergies for Cluster Development

Federal efforts to support for the growth of regional innovative clusters go well beyond these recent initiatives. Federal-state synergies for cluster development have also developed from research parks built around the hub of a national laboratory, from the early-state innovation funding awarded by the Small Business Innovation Research Program (SBIR) and by the outreach and technical advice provided by the Department of Commerce Manufacturing Extension Partnership.

The Case of the Sandia Research Park

Beginning in the 1980s, Congress sought to encourage National Laboratories, rich reservoirs of scientific and applied technological research, to commercialize their technology and encourage regional growth. The Federal Technology Transfer Act of 1986 required every federal laboratory to actively transfer technology to industry, universities, and state and local governments.[19] This process accelerated in the 1990s with policy measures and funding for

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[16] Congress established the SBA with the Small Business Act of July 30, 1953, to "aid, counsel, assist and protect…the interests of small business concerns" and to ensure small businesses get a "fair proportion" of government contracts. The SBA guarantees small-business loans. In 1982, the Small Business Innovation Research (SBIR) program was established to administer small grants by various federal agencies to boost commercialization of innovations derived from federal R&D, among other things.

[17] The Michigan Automotive Robotics Cluster Initiative Workshop, July 28, 2009

[18] The SBA's Regional Innovation Clusters aim to provide business training, counseling and mentoring to help grow existing small businesses and start-ups. SBA's Advanced defense technology clusters provide similar services to small businesses working in high-growth industries such as robotics, cyber-security and energy innovations

[19] The Federal Technology Transfer Act of 1986 (Public Law 99-502) amended the Stevenson-Wydler Technology Innovation Act (Public Law 96-480) and made technology transfer the responsibility of every Federal laboratory

CRADA.[20] Bureaucratic resistance and the reduction of funding for CRADA reduced the level of activity substantially. Provisions of the 2005 Energy Policy Act again sought to commercialize technologies based on research conducted at national laboratories, again with mixed response. [21]

Nonetheless, there has been significant progress in some quarters. For example, Sandia National Laboratories in Albuquerque, New Mexico, was among the first national laboratories to expand its mission beyond national security and systematically seek to commercialize government-sponsored research. One focal point of this effort has been Sandia's now well-established science park. [22] While not at the scale of many foreign parks, it is now is home to over 30 high-tech companies, employing over 2,000 people in industries as diverse as solar energy and software to nano-materials and semiconductor manufacturing equipment. The park continues to expand, and hopes to draw in an additional 4,000 jobs over the course of this decade.

Sandia's 'Separation to Transfer Technology' program has been an important element in the success of its cluster development efforts. The program allows scientists who work at Sandia National Laboratory to take leaves of absence for up to two years to join or help start up companies. If a business venture does not work out, the scientists can return to their jobs. Since 1994, 138 Sandia scientists and engineers have left the laboratory in New Mexico and its California affiliate, Lawrence Livermore National Laboratory, to enter business. As a result, at least 91 companies have been started or expanded.

Seed Capital for Innovation: The role of SBIR

The largest early-stage innovation program in the United States, the Small Business Innovation Research (SBIR) offers $2.5 billion a year in competitions and awards to stimulate technological innovation among small private-sector businesses while providing government agencies new, cost-effective, technical and scientific solutions to meet their diverse mission needs.

The challenge of incomplete and insufficient information for investors can pose substantial obstacles for new firms seeking seed capital. Given that attracting investors to support an imperfectly understood, as yet-to-be-developed innovation is especially daunting, the term *"Valley of Death"* has come to describe the period of transition when a developing

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scientist and engineer and mandated that technology transfer be considered part of employee performance evaluations.

[20] Created by the Stevenson-Wydler Technology Innovation Act of 1980 and amended by the Federal Technology Transfer Act of 1986, a CRADA (Cooperative Research and Development Agreement) is a written agreement between a private company and a government agency to work together on a project.

[21] Title X, Sections 1001, 1002, and 1003 of the Energy Policy Act of 2005 (PL 109-58) contained several provisions to promote technology transfer and commercialization by federal laboratories, including establishment of a technology transfer coordinator at the Department of Energy, a working group of laboratory directors, an energy commercialization fund, a technology infrastructure program, and a small-business assistance program.

[22] National Research Council, *A Review of the Sandia Science and Technology Park Initiative*, C. Wessner, ed., Washington DC: National Academies Press, 1999. The review provided an early validation the park's concept, its rationale and current plans, as well as identified potential operational and policy issues that helped to guide the growth of Sandia S&T Park.

technology is deemed promising, but too new to validate its commercial potential and thereby attract the capital necessary for its continued development.[23] This means that inherent technological value does not lead inevitably to commercialization; many good ideas perish on the way to the market often for the lack of sufficient funds.

In a recent comprehensive assessment of the program, the U.S. National Academies found that SBIR encourages the entrepreneurship needed to bring innovative ideas from the laboratory to the market by providing scarce pre-venture capital funding on a competitive basis (National Research Council, 2008). Further, by creating new information about the feasibility and commercial potential of technologies held by small innovative firms, SBIR awards aid investors in identifying firms with promising technologies. SBIR awards thus appear to have a "certification" function, acting as a stamp of approval for young firms and allowing them to obtain resources from outside investors (Lerner, 1999).

Recognizing the potential of this federal program, several states have sought to leverage SBIR to accelerate regional growth. The One North Carolina Small Business Program, for example, awards state matching funds to North Carolina businesses that have received funding from SBIR.[24] Some states have also initiated "Phase 0" programs to increase the chances of local firms of submitting a successful SBIR proposal.[25] In all of the regional development clusters programs, the dearth of early stage capital often remains a major obstacle to technology commercialization and small firm development; SBIR addresses this need

Practical Advice for Manufacturers: The Role of MEP

Organized under the National Institute of Standards and Technology (NIST), the US Manufacturing Extension Partnership (MEP) is a decentralized network of 59 centers, more than 300 local offices, and more than 1,000 professional specialists in all 50 states. The partnership provides "pragmatic assistance, appropriate to state and local conditions, with business services, quality systems, manufacturing systems, information technology, human resources, and engineering and product development ('soft' business practices)" (Shapira, et al, 2010).

Collaborating with other MEP centers, with other NIST programs, and with other public and private organizations, the partnership addresses the technological and business needs of companies, most of which are small and mid-sized companies. MEP's decentralized organization supports this approach by allowing each center, within certain operational and performance parameters, to customize its organizational model, service offerings, and delivery based on the needs of its clients and the institutional capabilities within its service region (Shapria, 2001).

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[23] For an empirical analysis of the Valley of Death phenomenon, see Lewis Branscomb and Philip Auerswald, "Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States," *The Journal of Technology Transfer*, 28(3-4), August 2003.

[24] For information on North Carolina's small business program, see http://www.nccommerce.com/scitech/grant-programs/one-n.c.-small-business-program

[25] For information on Florida's Phase 0 program, see http://www.eflorida.com/Why_Florida.aspx?id=8804

The Role of State and Regional Players

While the federal government has expanded its support in recent years, industry cluster strategies remain chiefly a concern of states, regions, and metropolitan areas. Many state and regional governments have taken a pragmatic approach to fostering innovation clusters, targeting industries such as semiconductors, batteries, flexible electronics, and robotics. In the U.S. Midwest, Michigan, Ohio, and Illinois are among states that have intervened actively to support innovation-based growth by fostering productive collaboration among private industry, universities, and government. Their initiatives have moved well beyond the traditional incentives such as tax breaks, free working training, and low-cost land and utilities long used by states to attract industries to locate in their states. As we see below, these states are providing grants and early-stage capital to stimulate and grow high-tech start-ups. They are also co-investing with universities, industry, and federal agencies to establish major research centers devoted to core applied technologies.

The experience of three states, Michigan, Ohio, and Illinois are briefly reviewed below, demonstrating the importance of local leadership, dedicated institutions, a sectoral focus, and complementary investments by the federal government in developing regional innovation clusters.

Building Michigan's Advanced Battery and Electric Vehicles Clusters

Michigan has been one of the boldest states in subsidizing new investment to renew and diversify its industrial base. Led by then Governor Granholm, the state legislature took a number of initiatives to develop new technological clusters that leveraged existing local strengths in engineering knowhow and automobile manufacturing to develop new industries in renewable energy and electric transportation.

The state offered some of the nation's most generous financial incentives for opening manufacturing facilities. It invested in start-ups through a 21st Century Jobs Fund and provided loans and grants to help larger companies commercialize manufacturing and green-energy technologies (National Research Council, 2013). The state also offered a variety of refundable tax credits, including special programs for companies that manufacture advanced batteries and solar-power equipment, companies that invest in smaller Michigan companies, and companies that invest at least $350,000 for new strategic innovation relationships.

The Michigan Economic Development Commission (MEDC) has worked with the private sector, universities, and federal agencies to identify emerging industries where the state enjoys strategic advantages and the opportunity to be competitive globally. From this process, MEDC selected the advanced energy-storage systems, equipment for wind and solar power, and bio-fuels industries. These sectors were seen to leverage Michigan's strengths in manufacturing, natural resources, existing parts and materials suppliers, and extensive university and corporate R&D (Shreffler, 2013). The state in partnership with industry also funded a university-based

research program called "Centers of Energy Excellence" to support clusters in these technologies.[26]

Michigan's new advanced battery cluster illustrates of the potential of state-federal synergies. Michigan's own substantial efforts to build a battery cluster was supported by $1.3 billion in federal funds for companies such as General Motors, Johnson Controls, XTreme Power, and South Korea's LG to build lithium-ion cell or battery-pack factories in the state. This federal investment has encouraged private companies to invest a further $5.2 billion, with the hope of creating up to 40,000 new jobs by 2017 and attract out-of-state manufacturers of related technologies. Growing demand by the military for electrified transportation is helping to reinforce the growth this new industry but there remain many questions concerning the adequacy of demand for these high cost, unproven vehicles (Zanardelli, 2013).

Building Ohio's Renewable Energy, Flexible Electronics, and Medical Clusters

The state of Ohio is financially backing the development of clusters as a part of its economic development strategy. Under the Ohio Third Frontier program, the state is investing $2.3 billion to support applied research, commercialization, entrepreneurial assistance, early-stage capital, and worker training to create an "innovation ecosystem" for a number of clusters.[27] Since its launch in 2002, Third Frontier is credited with creating 55,000 direct and indirect jobs, as of 2009; creating, capitalizing, or attracting more than 600 companies, and generating $6.6 billion in economic impact—nine times more than the state has invested (Camp et al, 2007). In 2010, Ohio taxpayers approved a $700 funding boost so that Third Frontier can continue its activities through 2015. These and other initiatives have doubled early-stage investment in the state to $445.6 million from 2004 to 2008 (Camp et al, 2007).

Northern Ohio is especially active in its efforts to diversify an economy that has been battered by a declining manufacturing base, accompanied by a rise in offshore outsourcing and imports. To counter this decline, state economic development officials are developing road maps to nurture clusters in sectors such as energy storage, photovoltaic cells, smart-grid technology, electric transportation, and conversion of biomass and waste into energy.

Concerted efforts are also underway by regional development organizations so that the next round of innovations can translate into regional industries. Federal awards are now complementing and reinforcing many of their initiatives. A key example is the Northeast Ohio Technology Coalition (NorTech), a nonprofit funded by business associations and foundations, is spearheading efforts to create a new cluster in flexible electronics in Northeast Ohio (Bagley, 2012). Funding from the federal government, including the U.S. Small Business Administration's Innovative Economies initiative, is helping to support the growth of regional clusters in flexible electronics.

Another group called Ohio Advanced Energy is seeking to advance the region's small but growing cluster in photovoltaic cells and modules. This effort is supported by the expansion of

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[26] Michigan's new Centers of Energy Excellence (COEE) program provides grants totaling $45 million over three years to for-profit companies that are commercializing innovative energy technologies with support from a university. http://www.michiganadvantage.org/News/Centers-of-Energy-Excellence-Program/

[27] http://thirdfrontier.com/

US Air Force funding to the University of Toledo from approximately $1 million to $3 million annually, as well as the award of a $1 million NASA grant to establish a photovoltaic test facility at the University of Toledo.[28] Another group, PolymerOhio, is working with the Manufacturing Extension Partnership to expand Ohio's strong bases in polymers and plastics, which includes 2,800 companies and research institutions employing 140,000 skilled workers.[29]

Another regional organization, BioEnterprise is promoting the development of a biomedical cluster in the Greater Cleveland area, which is supported by significant funding by the National Institutes of Health. The cluster has so far drawn together more than 600 companies, including imaging giants such as Philips, General Electric, Siemens, Hitachi, and Toshiba.[30]

Building Illinois' Innovation Ecosystem

Like its Midwestern neighbors, the state of Illinois is seeking to build on its strong research base, while developing the skills and partnerships needed to ensure that the region capitalizes on this investment. Describing the region's challenges, William Testa of the Federal Reserve Bank of Chicago, has said, "What we know about Chicago is that there is a yawning gap between our capacity and what we produce in new start-ups and businesses. In the last decade, we were in the top eight cities in federal funding from the National Institutes of Health, but we had very few biotech start-ups."[31] Similarly, David Miller of the Illinois Biotechnology Industry Organization, (iBIO) has observed that the region has always been strong in generating research, but it has lacked a corresponding ability to translate that research into companies that remain in Illinois.[32]

Seeking to build a more diversified regional economy, the state's universities, small and large businesses are working with the state and local governments to develop a variety of innovation partnerships. One example is iBIO, which supports small and large biotechnology companies, as well as start-ups in the medical, agricultural, and bio-industrial areas. Another example is the Illinois Science & Technology Coalition (ISTC), whose mission is "to cultivate and attract research and technology-based investment, talent and job growth in the state." Its member organizations include national laboratories, leading research universities, including the University of Chicago, Northwestern University, University of Illinois, Illinois Institute of Technology, large firms such as Abbott Laboratories, and Baxter, as well as industry groups, and non-profit organizations.

The region's universities are also seeking to expand and strengthen their partnerships with both industry and government. For example, the University of Illinois has established a

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[28] http://www.development.ohio.gov/ohiothirdfrontier/ToledoSolarHotspot.htm

[29] PolymerOne data. Access at http://www.polymer1.com/

[30] http://www.bioenterprise.com/

[31] Remarks by William Testa at the National Academies June 2012 symposium, "Building the Illinois Innovation Economy," Evanston, IL.

[32] Remarks by David Miller at the National Academies June 2012 symposium, "Building the Illinois Innovation Economy," Evanston, IL.

venture fund to enable faculty to commercialize their technology. A research park, which provides a physical locus for university-industry interaction, was built on the campus in Urbana in the late 1990s. The university is also developing partnerships with BP, Abbott Laboratories, and the Department of Energy that together have increased the University of Illinois' research budget by nearly 50 percent in the past decade to nearly $1 billion.

Recognizing that their region needs not only an entrepreneurial culture to build an innovation hub, but state-of-the-art infrastructure, the state government is also seeking to increase its support for the physical innovation environment. The State's Pathways Initiative calls for more than $8 million for a "gigabyte competition" that challenges communities in Illinois to submit ideas on how they would take advantage of hyper-fast broadband.

The Challenge: Sustaining Federal-State Synergies for Innovation Clusters

U.S. regional economies face mounting global competitive challenges. No longer do U.S. states and cities compete only among themselves for talent, investment, and entrepreneurs in technology-intensive industries. They also compete against national governments that are executing comprehensive strategies that seek to create regional innovation clusters in many of the same important, emerging industries being pursued in the United States. Nations around the world are backing up these strategies with heavy investment in state enterprises, new and renewed universities, public-private research collaborations, workforce training, early-stage capital funds, and modern science parks, all reinforced by strong policy attention from top leaders.[33]

This new competitive landscape is prompting federal, state and regional authorities in the U.S. to take creative and comprehensive approaches to developing innovation clusters. Federally funded research programs at universities and national laboratories are in some cases being oriented toward the activities of local industrial clusters. Government agencies such as the departments of Energy and Commerce are aligning a wide range of existing programs to accelerate the development of strategic technologies within regional clusters. In many instances, federal agencies are sharing best practices with regional agencies and are facilitating networking among researchers, investors, and support organizations across the U.S. There is much greater awareness of the potential benefits of clusters and a concerted effort to create synergies across multiple federal and state programs.

These initiatives, while promising, face a number of challenges. Perhaps foremost among things is a sharp decline in the availability of federal funds for these types of initiatives. Current budget limitations already run the risk of providing resources that are inadequate to meet the often expansive objectives of the federal and state agencies. Sustaining this momentum for greater state and federal cooperation in regional innovation cluster initiatives, however, is an important challenge. Political attitudes, as well as funding levels, can change swiftly. Moreover, the premise of close coordination of federal agencies and multiple state-based cluster initiatives will lead to greater synergies has encountered growing skepticism. While few question the principle, the practical efforts required for greater coordination are daunting and can often drain

[33] For a comparative review of national programs and policies around the world to support innovation, see National Research Council, *Rising to the Challenge: U.S. Innovation Policy for the Global Economy*, C. Wessner, and A. Wolff, eds., Washington DC: National Academies Press, 2012.

managerial energy at the federal, state, and operational levels. Shared information and broad alignment rather than close coordination may prove more promising going forward. The fundamental challenge faced by U.S. regional innovation cluster initiatives is the lack of policy consensus regarding their benefits at the state and especially the federal level with the attendant risk that the necessary continuity of policy and funding will not be maintained. This is particularly unfortunate in a world that has seen sustained efforts and great policy continuity by America's competitors.

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