

# Making an Impact

Assessing the Benefits of Ohio's Investment in  
Technology-Based Economic Development Programs:

Executive Summary



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# **Making an Impact:**

## **Assessing the Benefits of Ohio's Investment in Technology-Based Economic Development Programs**

### **Executive Summary**



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## STUDY BACKGROUND

In 2002, the State of Ohio launched a \$1.6 billion, 10-year commitment to support technology-based economic development through the creation of the Ohio Third Frontier. Three-quarters of the way through its first 10 years, program data, regional economic data, and anecdotal evidence point to the Ohio Third Frontier's positive short-term impacts and indicate that longer-term structural changes are taking root. In light of the challenging economic environment and difficult fiscal choices ahead, the Ohio Department of Development (ODOD) sought a rigorous, objective, and credible assessment of the impacts of key technology-based economic development (TBED) programs on Ohio's current economy, as well as indicators of future impact. ODOD engaged SRI International and its partner, the Georgia Institute of Technology's Enterprise Innovation Institute, with the guidance of the Ohio Third Frontier Advisory Board and Commission, to address a series of questions:

- What are the tangible economic impacts of the Ohio Third Frontier and related programs on Ohio companies, institutions, and universities?
- Does the return on these programs support their levels of investment?
- Do these programs place Ohio's high-tech industries on a path consistent with successful cluster development and move Ohio toward a higher growth trajectory?

## AN OVERVIEW OF TECHNOLOGY-BASED ECONOMIC DEVELOPMENT PROGRAMS IN OHIO

Ohio's thinking about issues related to technology-based economic development and how the state could play a catalytic role in this development dates back to the early 1980s. The state invested in the Thomas Edison Program in 1984, creating the Edison Technology Centers and Edison Incubators. The state's second major endeavor, nearly 20 years later, was to put in place a comprehensive set of programs to support world-class research in industry-aligned platforms, to encourage collaborative research and commercialization activities, and to spur new technology company formation. This ten-year, \$1.6 billion set of programs is known as the Ohio Third Frontier. In addition, the State introduced two programs to increase the availability of early-stage risk capital in Ohio. The first, in 1996, was the Technology Investment Tax Credit program, which provides tax-based incentives for risk capital investments in technology startups. The second, in 2003, was the Ohio Capital Fund overseen by the Ohio Venture Capital Authority. This program was designed to bring more venture capital firms to Ohio and to encourage more venture capital investments in Ohio companies. (See Table 1)

TABLE 1. OHIO'S MAJOR TBED PROGRAMS

THIRD FRONTIER PROGRAM (2002)	TOTAL AWARDS THRU 2008
<b>Research and Commercialization Collaboration</b>	
<b>Ohio Research Scholars Program</b> creates 26 endowed chairs at Ohio Universities	\$146.5M
<b>Wright Centers of Innovation Program</b> supports university-based Centers of Excellence in target technology platforms <sup>1</sup>	\$295M
<b>Research Commercialization Program</b> provides funds for applied research	\$190.1M
<b>Wright Projects</b> provides grants for capital equipment purchases	\$52.2M
<b>Entrepreneurial Support</b>	
<b>Entrepreneurial Signature Program</b> pairs high-growth-potential technology startups with experienced entrepreneurs, risk capital, network in six regions	\$84.8M
<b>Pre-seed and Seed Funds</b> award grants to pre-seed funds that invest in startups	\$34.8M
<b>Product Development Assistance</b>	
<b>Third Frontier Action Fund</b> awarded grants to pre-seed funds and to companies for applied R&D leading to near-term commercialization	\$18M
<b>Ohio Research Commercialization Grant Program (SBIR III)</b> awards grants to improve viability of technologies developed through Federal R&D projects	\$11.2M
<b>Fuel Cell Program</b> supports applied R&D to help commercialize fuel cell components produced in Ohio	\$39.9M
<b>Advanced Energy Program</b> supports applied R&D to commercialize advanced energy system components produced in Ohio	\$19.9M
<b>Cluster Development</b>	
<b>Ohio Innovation Loan Fund</b> provides subsidized debt financing to established companies to develop next-generation products and services	\$54M committed over program life
<b>Targeted Industry Attraction Grants</b> attract out-of-state companies in target industry sectors to locate new facilities in Ohio	\$3.4M
<b>Workforce Development</b>	
<b>Third Frontier Internship Program</b> places highly-trained students (up to the doctoral level) with Ohio tech-based industries	\$1.5M
<b>Thomas Edison Program (1984)</b>	
<b>Edison Technology Centers (7)</b> support the industrial competitiveness of Ohio companies in key industry verticals by providing access to technology and business expertise	Varies year-to-year; currently \$13M-\$13.5M/year
<b>Edison Technology Incubators (13)</b> assist technology-oriented startups during concept definition and development stages, allowing entrepreneurs to concentrate on development of their core product/service	Varies year-to-year; currently \$4M-\$4.5M/ year
<b>The Ohio Capital Fund/Ohio Venture Capital Authority (2003)</b>	
<b>Ohio Capital Fund</b> "Fund of funds" mechanism increases venture capital available for early-stage investment in Ohio companies	\$98.5M (of total \$150M)
<b>Ohio Technology Investment Tax Credit (1996)</b>	
<b>Technology Investment Tax Credit</b> provides tax credit to taxpayers who invest in small, Ohio-based technology companies	\$28.5M (of total \$45M set aside)

Note: <sup>1</sup>The five technology platforms targeted by the Third Frontier Program are: Biosciences; Advanced Materials; Advanced Energy; Instruments, Controls & Electronics (ICE); and Power & Propulsion.

In conceptualizing the Ohio Third Frontier, the State adopted the following technology commercialization framework to guide its program initiatives and review of related investments (see Figure 1). The framework employs five phases of commercialization characterized by the following forms of “proof” (in parentheses): 1) Imagining (commercial concept), 2) Incubating (business plan), 3) Demonstrating (commercial product and market entry plan), 4) Market Entry (product sales, growth plan), and 5) Growth & Sustainability (profitability). At the transition between each phase and the next is the need to mobilize resources.<sup>1</sup> Collectively, Ohio’s four TBED programs support the advancement of entrepreneurs and companies across this technology commercialization continuum.

**Figure 1. Ohio TBED Programs Along the Technology Commercialization Continuum**



Innovation is important to Ohio’s long-term economic growth because new products, services, and production processes provide Ohio companies with opportunities to enter new markets and to gain greater market share. Innovation affords Ohio’s economy the opportunity to diversify into higher growth, higher value-added economic activities that can move Ohio to a better growth trajectory. Ultimately, this will generate higher quality jobs and higher incomes for current and future generations of Ohio citizens.

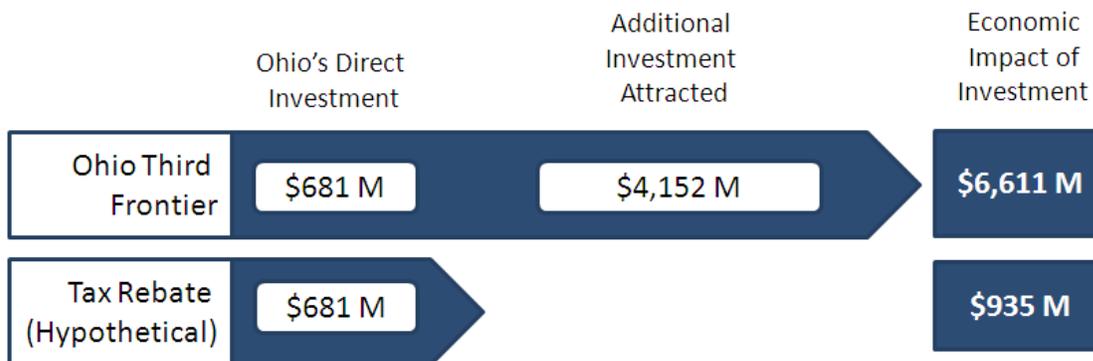
<sup>1</sup> BizLogx (2006). *Technology Commercialization Framework*. Columbus, OH.  
<http://www.as.yosu.edu/~adhunter/RFPs/CommercializationFramework.2006.03.25m.pdf>

## LEVEL OF INVESTMENT AND RETURN ON OHIO’S THIRD FRONTIER

What has been the return on the State’s investment in Ohio’s Third Frontier? The SRI study found that **the State’s expenditures of \$681 million generated \$6.6 billion of economic activity, 41,300 jobs, and \$2.4 billion in employee wages and benefits as a result of the Ohio Third Frontier.** This represents a nearly \$10 return on every dollar of the State’s investment.

For comparison, SRI also modeled a hypothetical scenario in which the State of Ohio returned this \$681 million to taxpayers. The estimated impact associated with this tax rebate is significant, \$934.6 million of economic activity, 6,400 jobs, and \$214.2 million in employee wages and benefits. However, the Ohio Third Frontier investments resulted in follow-on Federal and private sector investments and increased R&D activity, products sales, and construction, generating more than seven times the level of economic activity, more than six times the employment growth, and 11 times the wage growth for Ohio’s economy compared to that of a hypothetical tax refund.

**Figure 2. Ohio’s Investment in the Ohio Third Frontier Versus a Hypothetical Tax Rebate: Comparative Investments and Impacts**



Source: SRI International

It is important to note that this estimated impact reflects only State expenditures from 2003-2008. Ohio Third Frontier investments in future years are likely to generate much larger impacts for several reasons:

1. A majority of the Ohio Third Frontier funds remain to be spent. Some Ohio Third Frontier funds have not yet been awarded, and some funds awarded have not yet been spent in their entirety. The economic impact of the program is expected to increase significantly over the next five to ten years.

2. The Ohio Third Frontier and related initiatives are generating successful outcomes in spite of the longest U.S. recession in the post-World War II era.<sup>2</sup> It is likely that new products and processes being commercialized by Ohio companies and new industries which are emerging will be in a position of strength during the next global expansion.
3. Many intermediate impacts of the Ohio Third Frontier, such as new products and services resulting from university research and better linkages among research institutions, industry, and financial institutions, are long term in nature. Although many of these impacts have not had large economic effects yet, they are likely to have much more significant impacts in the long run.

## MAJOR ACCOMPLISHMENTS OF OHIO'S TBED PROGRAMS

### DRAMATICALLY INCREASING THE AVAILABILITY OF EARLY-STAGE CAPITAL

The Ohio Third Frontier's Pre-Seed Funds and Entrepreneurial Support Program, the Ohio Technology Investment Tax Credit, and the Ohio Capital Fund/Ohio Venture Capital Authority have contributed to a marked expansion in seed and early-stage capital from 2004-2008. This is important, since the availability of early-stage capital is critical to new company formation. According to a study by the Center for Entrepreneurship at Ohio State University, total seed and early-stage venture capital investment in Ohio expanded by 18.5 percent per year between 2004 and 2008 (from \$127.9 million to \$298.3 million). (See Chart 1)

According to the same study, between 2004 and 2008, total venture capital investment in Ohio grew by 13.2 percent per year (from \$243 million to \$445.6 million)—**more than double the annual growth rate of U.S. total venture capital investment** during the same five-year period (5.1 percent per year).

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<sup>2</sup> According to the National Bureau of Economic Research (NBER), the average post-World War II recession in the United States is 10 months.

**Chart 1. Growth in Ohio Venture Capital Investment, 2003-2008**



Source: Fisher College of Business Center for Entrepreneurship, The Ohio State University

## IMPROVING THE ENVIRONMENT FOR TECHNOLOGY ENTREPRENEURS

Entrepreneurship is a driving force of innovation and economic growth, yet entrepreneurs face significant challenges in transforming commercial opportunity into a viable business. In Ohio, the Ohio Third Frontier's six regional Entrepreneurial Signature Program (ESP) lead organizations and 13 Edison Technology Incubators are key resources for helping translate innovative ideas into investment-worthy companies through business assistance and pre-seed investments in startup companies. These programs report the following results:

- From 2007 to 2008, Ohio's six regional ESP organizations invested \$36 million in direct business assistance and pre-seed capital funding to 81 companies which then resulted in product sales, follow-on investment, and funding totaling \$145 million. Moreover, some ESP regions report significant excess deal flow (e.g., 150 total deals in which they would have liked to have invested if more investment capital had been available).
- For the fiscal year ending 2008, Ohio's 13 Edison Technology Incubators supported 270 startup companies which reported \$262.2 million in product sales, research grant awards (e.g., SBIR, STTR, etc.), and other revenue, and \$120.8 million in equity investments by private investors, venture capital funds, and others.

### Assessing the Benefits of Ohio's Investment in TBED Programs

The number of technology startups supported by quality entrepreneurial assistance programs is important to the state's bottom line. Recent research by the U.S. Small Business Administration indicates that raising the number of small-business startups by 5 percent tended to boost gross state product (GSP) by 0.465 percent, increase a state's employment growth by 0.435 percent, and raise personal income by 0.405 percent. Similarly, small-business deaths detract significantly from state economic growth, employment, and personal income. A 5 percent increase in startups is equal to roughly 445 new small businesses in Ohio.<sup>3</sup> **Therefore, if the Ohio Third Frontier ESP and Edison Incubator programs achieve a net increase of 450-500 technology startups over the next 10 years, they will have contributed one-half of one percent to Ohio's GSP growth.** Ohio's economy grew 1.9 percent from 2007-2008.<sup>4</sup>

### IMPROVING R&D COLLABORATION

A key factor in successful technology-based economic development is getting industry, universities, and other research institutions to be aligned in their interests and to collaborate in their actions. A central aspect of the Ohio Third Frontier has been to support university research in areas that are aligned with Ohio's existing and emerging industrial and technological strengths. The Wright Centers, Wright Projects, Research Commercialization Program, and Ohio Research Scholars Program all support university work that is aligned with industry needs.

In addition, the Ohio Third Frontier and Edison Program have supported a variety of "bridging" organizations that build effective collaborations between companies, universities, Federal laboratories, and other research institutions. Such organizations are widely recognized to be critical in economic development.

### CleveX ExiClip Device Poised to Seek FDA Approval

CleveX, Inc., a Columbus-based dermatological medical device company, was able to leverage Ohio's Technology Investment Tax Credit (TITC) to raise a \$1.65 million first round of financing led by the Ohio TechAngels Fund. This pre-seed fund was capitalized with support from the Ohio Third Frontier. The early-stage investment enabled CleveX to complete design and testing, and to seek FDA approval for its ExiClip device. A follow-on \$1.4 million investment enabled CleveX to begin high-volume manufacturing. This investment round was led by Reservoir Venture Partners, a Columbus-based venture capital fund leveraging the Ohio Capital Fund.



Image (above): ExiClip  
Photo credit: CleveX

<sup>3</sup> Bruce, D., et al (2007). "Small Business and State Growth: An Econometric Investigation." U.S. Small Business Administration Office of Advocacy.

<sup>4</sup> U.S. Bureau of Economic Analysis. Ohio gross state product (GSP) growth is in current dollars.

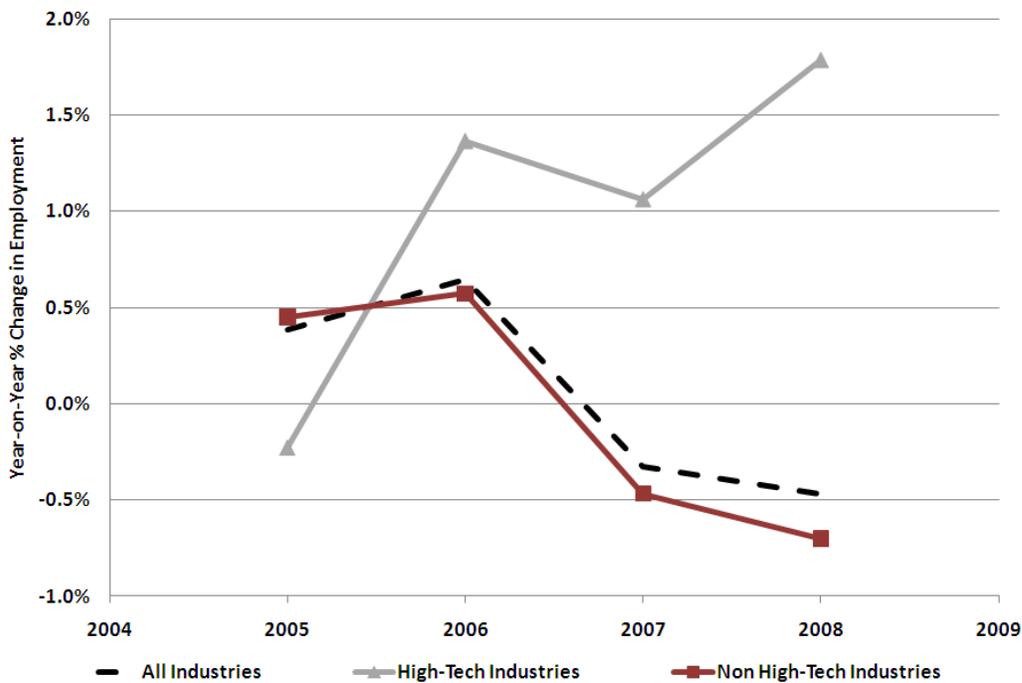
For example, the Edison Center, BioOhio, has brought together bioscience assets in the state to work together effectively. Similarly, the Institute for the Development and Commercialization of Advanced Sensor Technology (IDCAST), an Ohio Third Frontier Wright Center, has helped to connect Ohio sensor technology companies with Ohio universities and laboratories, especially the Air Force Research Laboratory (AFRL), to enable both research collaboration and market development. Other Ohio Third Frontier and Edison supported organizations are doing similar functions in different technologies and regions.

Interviews with stakeholders clearly indicated that the Ohio Third Frontier is improving both the research infrastructure and research collaboration in the state. Universities centers, such as the Liquid Crystal Institute at Kent State University, that in the past licensed their technology to overseas companies, are now collaborating with Ohio companies. Indicators of universities' connection to industry, such as industry funding of university research, university licensing revenues, and the number of university-based start-up companies, are all showing positive trends. Although there remains work to be done to improve these linkages, Ohio Third Frontier has significantly strengthened linkages among universities, industry, and research laboratories, especially in the targeted technology areas.

## DRIVING EMPLOYMENT GROWTH IN OHIO'S TECHNOLOGY SECTOR

Employment in Ohio's technology sector is growing. A recent study commissioned by NorTech and conducted by the Center for Economic Development at Cleveland State University found that between 2004 and 2008, total employment in Ohio's high-tech industries grew 4.0 percent, adding 19,198 jobs, in spite of the current recession which began in 2007. By contrast, all other industry sectors in Ohio declined by a total 7,247 jobs. In 2008, Ohio's technology sector employed approximately 495,000 people, accounting for 9.5 percent of total employment in Ohio, and mirroring the high tech sector's representation nationally. (See Chart 2)

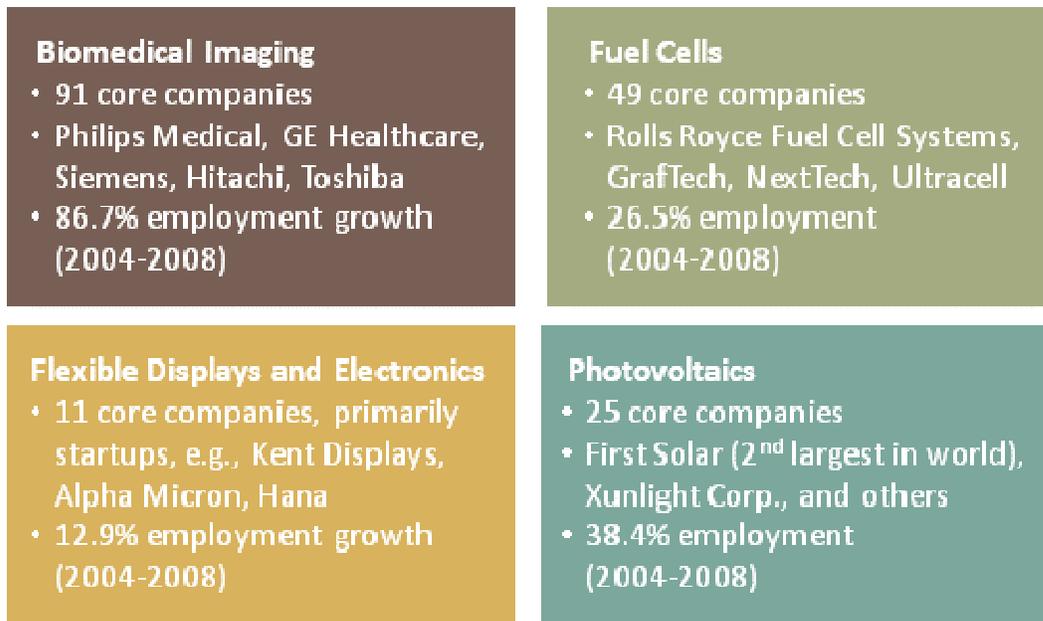
**Chart 2. Ohio High-Tech and Non High-Tech Employment Growth, 2004-2008**



Source: NorTech and the Center for Economic Development at Cleveland State University's Maxine Goodman Levin College of Urban Affairs.

Within Ohio's technology sector, Ohio Third Frontier and related investments are catalyzing the emergence of new technology clusters, fueled by recent and on-going commercialization of new technologies. These emerging clusters include such areas as: Biomedical Imaging and Medical Devices more broadly, Liquid Crystals/Flexible Displays, Fuel Cells, and Photovoltaics. All of these clusters strongly leverage Ohio's existing advanced manufacturing supply chain.

**Figure 3. Ohio's Emerging Technology Clusters and Employment Growth, 2004-2008**



## CONTRIBUTING TO THE DIVERSIFICATION AND COMPETITIVENESS OF OHIO MANUFACTURERS

The Ohio Third Frontier is making direct investments in Ohio companies which are using R&D to retool to stay competitive, as can clearly be seen in the stories of traditional manufacturers like Pilkington, American Trim, and Owens Corning. American Trim, a metal forming and coating company, has won Ohio Third Frontier R&D awards to develop an environmentally-friendly "chrome-like" coating for bumpers and a novel metal forming technology for the manufacture of fuel cell plates. This has enabled American Trim to enter new markets and to compete internationally. Pilkington is using Ohio Third Frontier-supported R&D to shift from the traditional production of glass and glass fibers to new cutting-edge materials for the photovoltaics and wind turbine markets. Pilkington has been a recipient of Ohio Third Frontier investments in Ohio's photovoltaics industry through direct company awards and the services of the Photovoltaics Innovation Center (PVIC) at the University of Toledo, an Ohio Third Frontier Wright Center. Owens Corning was a partner and recipient of an Ohio Third Frontier grant in 2007, along with the Center

for Multifunctional Polymer Nanomaterials and Devices (CMPND) at OSU, another Ohio Third Frontier Wright Center, to develop longer, stronger windmill blades using nanotechnology.

The Ohio Third Frontier directly funds technology research and commercialization through a competitive proposal process. On a broader scale, Ohio's seven Edison Technology Centers assist a variety of Ohio manufacturers by providing technical assistance, as well as serving as conduits to expertise in Ohio technology companies, universities, and research institutions.

## RECRUITING NON-OHIO COMPANIES

There is substantial evidence that Ohio's TBED programs have improved the attractiveness of Ohio as a site for technology-based companies. While many factors are weighed in corporate site selection processes, the presence of strong university-industry research centers, supportive state programs, and emerging technology industry clusters all "shift the needle" toward Ohio in site selection decisions. Interviews with several companies spanning the fuel cell, advanced materials, photovoltaic, and medical imaging industries confirmed that Ohio TBED programs were important factors in their corporate decisions to locate in Ohio.

In 2006, 2007 and 2008, *Site Selection* magazine awarded Ohio the prestigious Governor's Cup for the most new facility locations and expansions. In 2008, Ohio beat out Texas, North Carolina, Illinois and Tennessee to take the top spot, with 503 new projects. Ohio's cities also received recognition. Cincinnati, Columbus and Cleveland ranked in the Top 10 for large metropolitan areas; and Dayton, Akron, Toledo and Youngstown-Warren ranked in the Top 10 for metropolitan areas with populations between 200,000 and 1 million.

### Ohio's Advanced Manufacturing Base: Bringing New Products to Market

A few years ago, Texas-based Zyvex Performance Materials (ZPM) lacked the capability to manufacture the nano-enhanced composite materials it had developed. PolymerOhio, an Edison Technology Center, connected the company with an Akron-based manufacturer that could manufacture the products that ZPM developed. "This example demonstrates why we moved here: there is already a strong advanced materials infrastructure in place, and almost our entire supply chain is in Ohio," commented ZPM President Lance Criscuolo. Today, ZPM is headquartered in Columbus, Ohio.



*Image: Aldila golf shaft incorporating Zyvex composite materials and used by PGA Tour players.  
Photo credit: Zyvex Performance Materials*

## CHARTING A COURSE CONSISTENT WITH SUCCESSFUL TECH-BASED GROWTH IN OTHER REGIONS

Stakeholder interviews and case studies indicate that the focus and implementation of Ohio's Third Frontier is highly consistent with the best practices adopted in other technology-based clusters. Regions that excel in technology-based clusters today—Silicon Valley in California; Boston/Route 128 area in Massachusetts; the Research Triangle area in North Carolina; and the greater Austin metro area in Texas—share a number of common historical and present-day attributes, including:

- Pioneering, research-intensive companies and top research universities that produce world-class research outputs, as well as a highly skilled workforce;
- The visionary leadership of regional leaders who aggressively sought State and Federal investments in strategic research, including Federal defense technology research investments in Silicon Valley and Boston; State investments in greenfield research parks and biotechnology in the Research Triangle; and private industry investments to create endowed chairs at the University of Texas;<sup>5</sup>
- Strong networks between the research, finance, and business communities; and
- Strong infrastructure for entrepreneurship in the technology sectors including ample early-stage capital and programs to support technology transfer and startup companies.

Ohio's Third Frontier and related programs represent a comprehensive approach to developing all of these attributes in Ohio.

## LOOKING FORWARD TO 2012: DEVELOPING OHIO'S THIRD FRONTIER

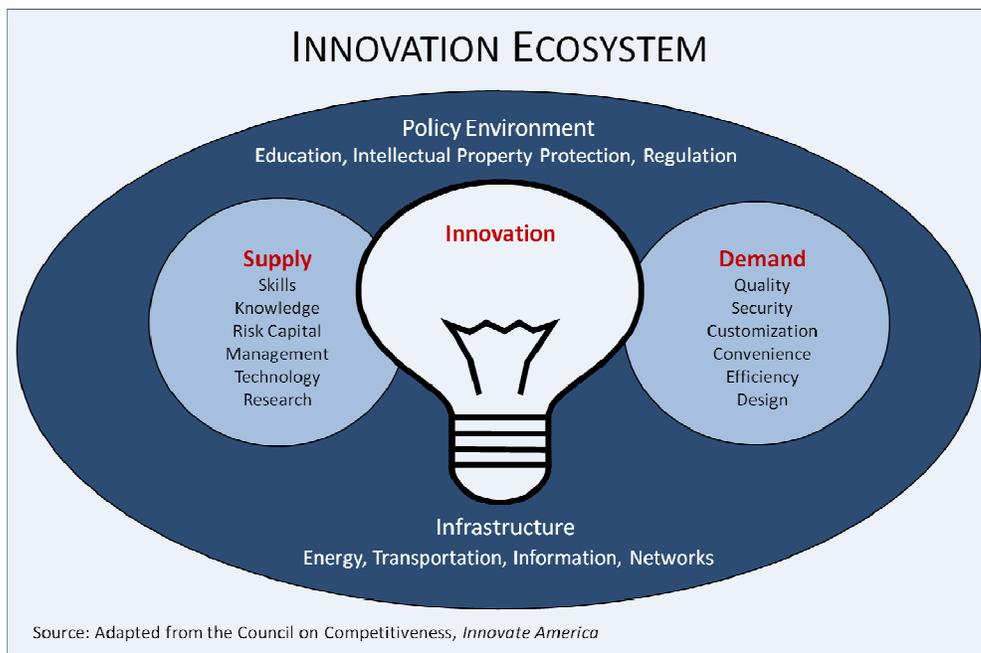
Although the economic impacts to date are substantial, the more important effect of the Ohio Third Frontier is likely to be its long-term effects on Ohio's system of supporting innovation. The Ohio Third Frontier and related initiatives have created an effective, integrated system for supporting innovation at all levels and by all actors, including companies, entrepreneurs, universities, research institutions, and Federal labs.

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<sup>5</sup> Since 1984, more than forty \$1 million-endowed chairs have been created at The University of Texas to recruit distinguished faculty and facilitate research in engineering and the natural sciences, with an emphasis on microelectronics, material sciences, physics and computer sciences. This initiative was a significant contributor to the ability of Austin to attract the Microelectronic and Computer Technology Corporation (MCC) and SEMATECH, and it spurred rapid semiconductor and IT-related growth in the regional economy.

It is now well understood that a region's capacity for innovation depends on an effective system that involves many elements, including R&D, skilled people, financing, market pull, a supportive policy environment, and other elements.<sup>6</sup> Figure 4 presents one depiction of the elements of an effective innovation system.<sup>7</sup> The lack of any element can cripple the overall functioning of the system.

**Figure 4. Determinants of the Supply and Demand for Innovation**



How have Ohio's investments in the Ohio Third Frontier and related initiatives improved Ohio's innovation support system? The Ohio Third Frontier looked strategically at the key factors which determine innovation capacity and made investments on a scale that could make a difference. Historically, Ohio has had significant research assets and skill sets in its industrial sectors, manufacturing supply chains, universities, Federal labs, and other research institutions. The Ohio Third Frontier has successfully filled in the missing elements of risk capital and entrepreneurial skills, and catalyzed the connections between the various elements in the technology commercialization continuum ensuring that the whole is greater than the sum of its individual

<sup>6</sup> Nelson, Richard R. *National Innovation Systems: A Comparative Analysis*. Oxford: Oxford University Press. 1993.

<sup>7</sup> Council on Competitiveness. *Innovate America*. National Innovation Initiative Report. Washington. 2004.

parts. The result is a comprehensive system to support the development and commercialization of new technologies that can change Ohio's growth trajectory in the coming decades.

The evidence presented in this report suggests that the Ohio Third Frontier is off to a good start and has a substantial record of accomplishment. As it goes forward, there is a need for both continuity and change. Continuity and consistent effort will be required to grow the businesses and clusters that have been started. The experience of other states and clusters, such as Silicon Valley, Research Triangle Park, or Austin, is that it takes 20 to 30 years for regions to achieve the critical mass that becomes self sustaining. We believe that the Ohio Third Frontier can be enhanced with greater communication efforts, both about the initiative and about Ohio's unique strengths. The Ohio Third Frontier can also be made more cohesive across the different institutions and regions of the state, and may consider expanding its scope to include more creative industries, such as consumer products. With regard to program balance, university programs, entrepreneurial support programs, and company relocation programs are all part of an effective system. SRI believes the university programs should be maintained, but there should be a modest readjustment to place greater emphasis on entrepreneurial support programs and efforts to attract new growing technology companies, especially in Ohio's expanding technology clusters.

As is the case with geographic frontiers, the economic benefits of new technological frontiers come not from the initial exploration but from the subsequent development. This is the case with the Ohio Third Frontier. The initial stages have developed research capacity and partnerships, ideas and intellectual property, and fledgling technology-based companies and industries. Most of the economic benefit, however, will come from the subsequent development and growth of these companies, along with supporting industries. Based on the findings of the analysis laid out in this report, SRI believes that the Ohio Third Frontier has been an effective program. If Ohio's goal is to continue to support the growth and emergence of technology-based industries in the state, SRI believes the continuation of the Ohio Third Frontier is an effective strategy and is well warranted.