Michigan 21st Century Jobs Trust Fund—Entrepreneurship and Innovation Programs Impact and Effectiveness Study

Performed for:

Michigan Economic Development Corporation

Performed by:

TEConomy Partners, LLC

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TECONOMY PARTNERS LLC

Innovating Tommorow's Economic Landscape

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Executive Summary

21st Century Jobs Fund—a Driver of Significant Economic Impact

For most states, promoting entrepreneurship has not been part of the mainstream programmatic efforts of traditional economic-development policy. However, for those states that have had the foresight to focus on technology-based economic development to meet the needs of the 21st century, significant investments have been made in programmatic efforts to foster an environment that supports both innovation and entrepreneurship. Michigan has been one of the states with such foresight.

The state of Michigan has committed significant resources to grow Michigan's innovative economy through the programmatic activities and investments of the Michigan Strategic Fund (MSF) since 1984. In 2005, the MSF's enabling legislation was modified (Act 215, P.A. 2005 and related legislation) to create the 21st Century Jobs Trust Fund program with appropriations and proceeds from the state's portion of the tobacco settlement revenue. The goal of this program and its components are to make investments and award grants and loans to help diversify the economy of the state, to help create jobs, and to provide for economic development.[1] Since the 21st Century Jobs Trust Fund Initiative (or the 21st Century Jobs Fund or 21st CJF) was created in 2005, $261.6 million has been invested in innovation and entrepreneurship efforts across Michigan assisting nearly 1,400 companies and new entrepreneurial start-ups—either directly or through service intermediaries. Of those, 1,073 companies were actively operating in Michigan in 2014.

Together, these companies directly employed more than 11,000 workers in 2014, with estimated wages and benefits of nearly $879.5 million (Table ES-1). The direct effect of these workers is estimated to generate $3.2 billion in output and, in turn, support nearly $48.4 million in state and local tax revenue.

Table ES-1. Total Economic Impact of 21st CJF Portfolio Companies, 2014

Impact Type	Employment	Labor Income	Output	State & Local Revenue
Direct Effect	11,006	$879,456,355	$3,226,910,706	$48,378,896
Indirect Effect	7,516	$419,102,077	$1,228,406,408	$53,914,134
Induced Effect	8,316	$341,009,126	$1,047,846,068	$63,193,825
Total Impacts	**26,839**	**$1,639,567,559**	**$5,503,163,182**	**$165,486,851**
Multiplier	*2.44*	*1.86*	*1.71*	

Source: Analysis using 2014 IMPLAN State of Michigan impact model.

When combined with the additional indirect output from supplier firms and the induced effects of worker spending throughout the Michigan economy, the estimated total impacts of the companies receiving 21st CJF support reaches:

- More than 26,800 jobs
- $1.6 billion in total labor income, and
- $5.5 billion of total economic output.

[1] From 21st Century Jobs Trust Fund Program annual reports and Michigan Senate Fiscal Agency, *State Notes*.

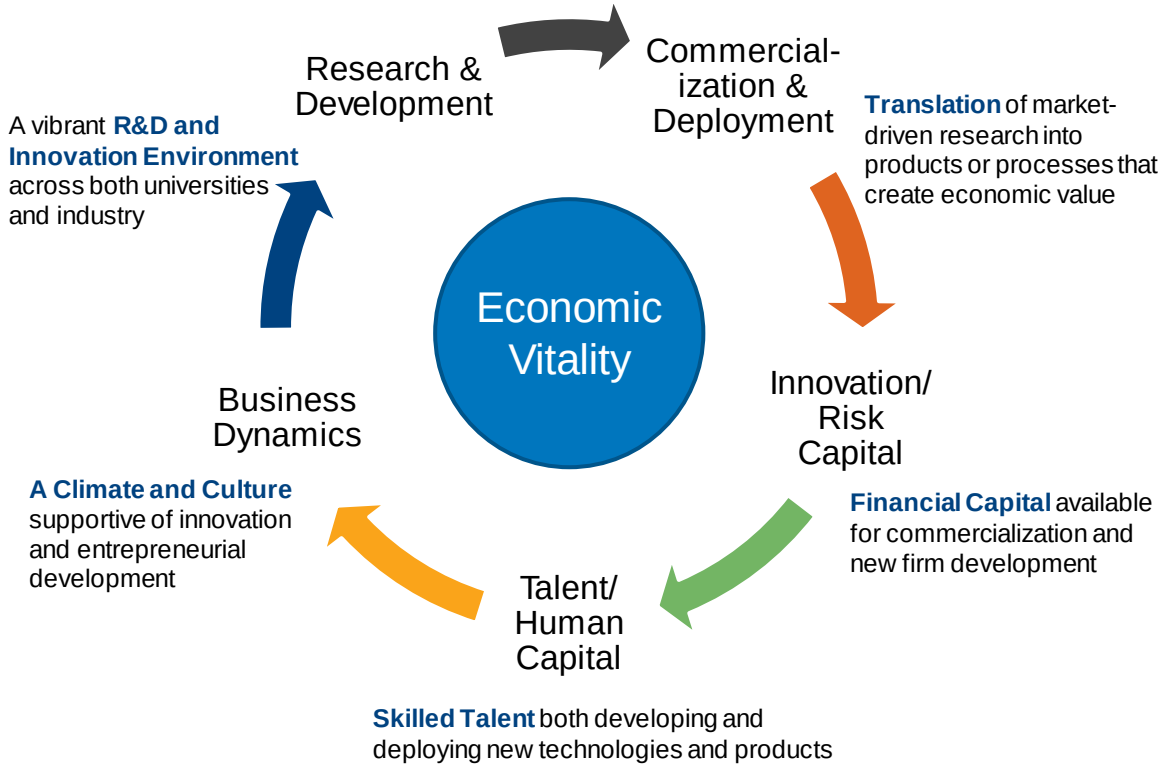
In other words, $1.00 in cumulative 21st CJF investment leverages additional private-sector innovation, operations, and capacity, resulting in $21.00 of total annual economic output for the state of Michigan. This indicates that these investments and initiatives of the portfolio have indeed spurred significant economic activity in the state.

From a purely state investment and revenue perspective, these companies, their suppliers, and their workers are estimated to have generated more than $165 million in state and local tax revenues through their 2014 operations. This one-year value alone represents 63.3 percent of the cumulative 10-year 21st CJF investments. Examined differently, if these cumulative investments are annualized over the 10-year period, yielding an annual average investment level of $26.16 million, these annual state and local tax revenues greatly exceed this level of investment. Under this approach, $6.33 is returned in state and local taxes in 2014 for every $1.00 of annualized 21st CJF investment.

21st Century Jobs Fund—Changing the Innovation/Entrepreneurial Ecosystem of Michigan

For innovation and entrepreneurship to thrive within a region, an entire interconnected sequence of positive factors has to be in place that connects and strengthens the drivers of business growth and development. If components of the ecosystem either inadequately address economic needs or are missing altogether, a sustainable value-added economic base able to generate quality jobs and impact economic vitality with a state is unlikely to develop (Figure ES-1).

Figure ES-1. Components of a Robust Innovation/Entrepreneurial Ecosystem that has the Capacity to Impact the Economic Vitality of a State



Since the 21st CJF Initiative was created in 2005, investments in programs and initiatives have been focused on ensuring the cultivation of a robust innovation/entrepreneurship ecosystem by investing in programs that:

- Catalyze the growth of technology start-up companies
- Increase the availability of risk capital, and
- Foster the commercialization of new products, processes, and services.

By analyzing the three thematic areas of investment—talent, capital, and product—areas of programmatic strength can be identified that have altered the entrepreneurial landscape of Michigan for the better, as well as where gaps or shortfalls within the ecosystem still exist that will need to be addressed through future investments.

Growth of Technology Start-Ups

Prior to the creation of the 21st CJF, there was minimal start-up activity in Michigan. The 21st CJF helped to fund both statewide efforts as well as regional activities that spurred entrepreneurial services and assistance. Today, a robust entrepreneurial-service delivery system is in place that provides regional services through regional models targeted at meeting more localized needs, as well as statewide through Michigan's SBDC Tech Team program. These services work to fill the void of managerial talent to help companies launch and grow in the state of Michigan.

While there is broad consensus that the innovation and entrepreneurship climate has greatly improved, there is also a widely held understanding that much more is left to be done. As ES-2 indicates, even with the growth of support services, Michigan's level of entrepreneurial business dynamics has not been significantly altered on the macro-level scale. When compared with the benchmarks and the nation, Michigan ranks in the middle in terms of the number of high-growth companies and is below the national average in terms of the number of new firm formations.

Table ES-2. Business Dynamics in Michigan

Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
New Firm Startup Rate	Rate of New Firm Formation as a Percent of All Firms, 2012	6.7%	8.1%	7th
	Percentage Pt. Change, 2004–12	−1.8%	−2.2%	6th
Employment in Younger Firms	Share of Employment in Firms Ages 0–5 years old, 2012	11%	11%	4th
	Percentage Pt. Change, 2004–12	−3.3 % pt.	−3.4 % pt.	7th
Presence of High-Growth Companies	Number of Companies on the Inc. 5000 List of Fastest-Growing U.S. Companies, 2014	130	n/a	6th
	Change in Companies in Inc. 5000, 2007–14	−16	n/a	8th

Sources: U.S. Census Bureau Business Dynamics Statistics (BDS), 2004–2012. The BDS data are compiled from the Longitudinal Business Database (LBD), a longitudinal database of business establishments and firms covering the years between 1976 and 2012. Inc. 5000 website (www.inc.com/inc5000). Data for selected benchmark states for 2007 (earliest available) and 2014 (most recent available).

Availability of Risk Capital

Prior to 2004, the availability of risk capital was extremely limited, with indigenous funding at the angel and pre-seed level being nonexistent. Michigan was considered a "flyover" state by national venture capitalists, and most of the funding that did exist in the state often left to invest elsewhere. Today, there has been significant growth in the level of indigenous funds available (with significant emphasis in pre-seed funding and a growing level of interest in angel funding) and increasing presence of national funds with a regular presence in the state.

Examination of Michigan Venture Capital Association (MVCA) data indicates that both the number of venture capital firms with a presence in Michigan as well as the level of risk capital investments have grown significantly over the decade (Table ES-3). Between 2006 and 2014

- The number of venture capital firms located in Michigan more than doubled;
- The amount of venture capital under management among firms operating in Michigan nearly quintupled;
- The amount of venture capital invested in Michigan start-ups by Michigan venture-capital firms nearly doubled; and,
- The number of deals (number of firms receiving investments) nearly tripled.

Table ES-3. Michigan Venture Capital Investment Activity

Measure	Definition	2006	2014	Growth
Michigan Venture-Capital Firms	VC Firms Located in MI	15	37	+22; 146%
	VC Investment Professionals in MI	40	115	+75; 188%
	VC Under Management among Firms Operating in MI	$0.9B	$4.8B	+$3.9B; 467%
Venture Capital Investments	VC Investments in MI Start-ups from MI VC Firms	$103M	$204M	+$101M; 98%
	# MI Startups Receiving VC Investments from MI VC Firms	13	51	+38; 292%
	$ Share of VC Investments at Seed + Early Stage	n/a	66%	n/a

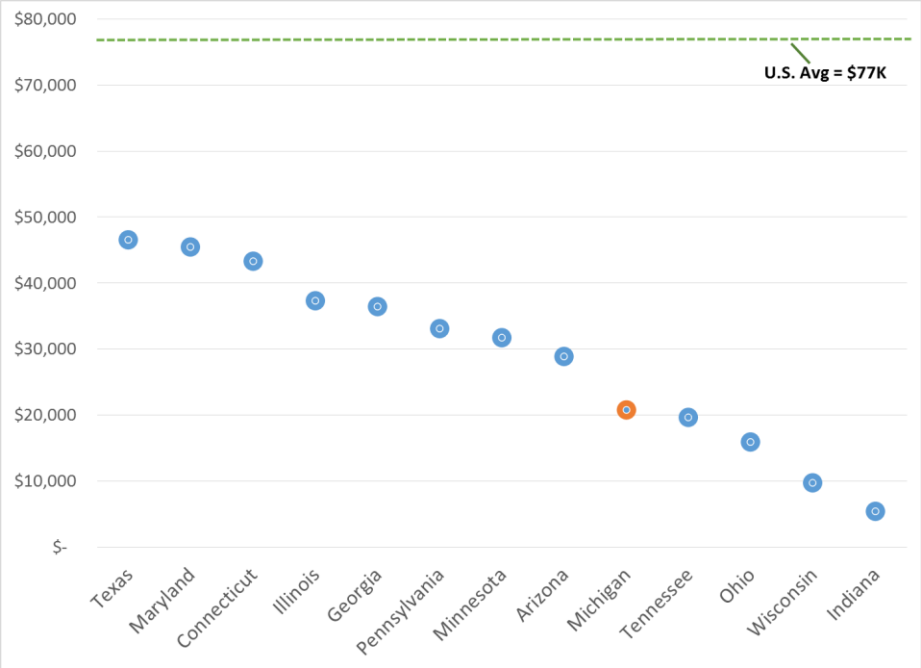
Source: MVCA.

Michigan's ability to attract and grow such a significant level of investment activity was in part due to the fact that the 21st CJF helped to legitimize the fund-raising efforts of new funds through its own investments, thereby helping to catalyze the creation and growth of indigenous funding activity. This in turn helped Michigan to develop a reputation of having successfully stimulated a growing risk-capital market with investable deal flow, which in turn attracted national venture-capital firms to look at and invest in Michigan deals. The bottom line is that, as of 2014, 21st CJF investments in risk-capital financial programs totaled $204.7 million over the time period, which had leveraged an additional $621.3 million in follow-on private risk-capital investments, a leverage ratio of 3 to 1.

While there is broad consensus that the risk capital climate has greatly improved, there is also a widely held belief that the investment culture is at great risk of disappearing without further additional

investments by the state. Even with the sizable growth in the level of risk capital investments, Michigan still falls below the national average of venture capital investments when the data are normalized (Figure ES-2) and ranks ninth amongst the benchmarks. It is a widely held belief that the national venture-capital funds are monitoring Michigan's risk capital landscape, and, if investors think the state is not committed to supporting entrepreneurial development, then they will disengage and invest their funds' resources in regions that are committed to building an entrepreneurial culture. As a result, the risk capital climate is very fragile and can easily be disrupted.

Figure ES-2. Venture Capital Investments per $10M in GSP, 2012–14



Source: Thomson Reuters Thomson ONE venture capital database.

Commercialization and Deployment of New Products, Processes, and Services

Michigan's academic research institutions have recognized the importance of commercializing and deploying the technology it develops and, as a result, has increased their focus on business engagement over the last decade. This focus includes incorporating more flexibility with IP terms and undertaking master agreements. In addition, the universities have become more engaged with student entrepreneurship efforts as well as integrating themselves into regional economic-development efforts, including regional incubators, entrepreneurial support services, and risk capital investors.

Even with this changing culture, Michigan still lags the nation and other benchmarks in key university technology-transfer outcomes. While some of these statistics might be lagging reality, it is still unclear whether or not important strides are being made. Furthermore, while Michigan's standing with regard to R&D is still strong, there are indications that this strength may be waning, and the state could lose ground to its competitors because of a lack of connection between industry and academia. These

barriers could lead to a gradual slowing of innovation in the larger Michigan economy, which will need to be overcome if Michigan is to capitalize on its homegrown innovations moving forward.

To this end, early 21st CJF investments were awarded directly to companies for commercialization efforts; however, for the most part, results were limited. The investment portfolio has been restructured, and the current investments in commercialization funds through intermediaries (universities and, in some instances, service providers) has helped to improve the overall climate. However, with the rapid evolution of programmatic commercialization efforts (MUCI, MIIE, MCRN, T3N, M-TRAC, UCF), there is concern that good programmatic aspects have been either underfunded or discarded with elements that were viewed as not working.

Strategic Recommendations for the 2nd Decade of the 21st CJF

After over a decade of investment, Michigan is now asking what additional needs still exist to foster the robust development of the innovation development chain. Based on a review of the impact of Michigan's innovation and entrepreneurship efforts, how these efforts have positioned Michigan against the nation and other states, as well as a review of the current strengths and barriers facing innovation and entrepreneurship, a series of recommendations were identified to encourage and support innovation and entrepreneurship in Michigan for the coming decade. These recommendations focus on the following:

Providing the requisite talent that covers the continuum of needs from early-stage start-ups to scalable enterprises. Specifically, 21st CJF should:

1. Develop an Executive Connect Program
2. Develop Cluster-Specific Entrepreneur-in-Residence Programs
3. Provide Additional Funding for the Executive Attraction Program
4. Streamline Entrepreneurial Service Providers to Ensure Consistent Value-Added Assistance Statewide

Facilitating access to risk capital at all stages of development. Specifically, 21st CJF should:

5. Create the Third Fund of Funds with Restructured Terms and Strong Ties to the Michigan Pension Fund and Other Institutional Investors
6. Provide Funding for Additional Rounds of Pre-Seed/Seed Funds
7. Foster Angel Networks and Investments

Fostering the commercialization and deployment of new products. Specifically, 21st CJF should:

8. Create Proof-of-Concept Funds
9. Create a Sector-Specific Matching Grant Program

Providing improved programmatic oversight and operational management. Specifically, 21st CJF should:

10. Develop a Revised Reporting System Built Around a Customer-Relationship Management Tool That Reduces Redundancy and Effort; Supports Service Provision, Efficiency, and Programmatic Connectivity; and Increases Data Accuracy

11. Undertake Analysis of Innovation Industry Clusters to Determine How Best to Support Their Unique Sector Needs, Thereby Helping to Create "Stickiness" by Tying Entrepreneurial Efforts to Larger Economy.

Now is the time for Michigan to reinvest in its commitment to transition the state's economy into a 21st century knowledge economy driven by innovation. When it began its initial investments through the 21st CJF over a decade ago, Michigan was laying the foundation for a sustained, high-growth recovery that would enable the state to "leap forward" and become a leading job- and wealth-generating economy. State leaders understood that, in today's global knowledge-based economy, the recipe for economic success is quite simple—Michigan must focus its economic development efforts to ensure that its existing industry drivers can raise their level of competitiveness and added value and that it can identify new drivers of innovation to improve the state's economic prospects.

Over the past decade, as a result of the investments of the 21st CJF, Michigan has developed and is implementing strategies aimed at growing its technology sectors through innovation and entrepreneurship. A key principle of these investment strategies is that they are all predicated on building on the state's strengths, including its university and industry sectors, and encouraging the growth of new and existing business ventures. A strong entrepreneurial community will be essential to realizing these goals. Entrepreneurs, after all, are the people who turn research findings and discoveries into viable business opportunities. Michigan, however, like most of the industrial Midwest, does not have a long history of technology entrepreneurship and must therefore work to nurture and support aspiring entrepreneurs and, in some cases, attract them to locate in Michigan.

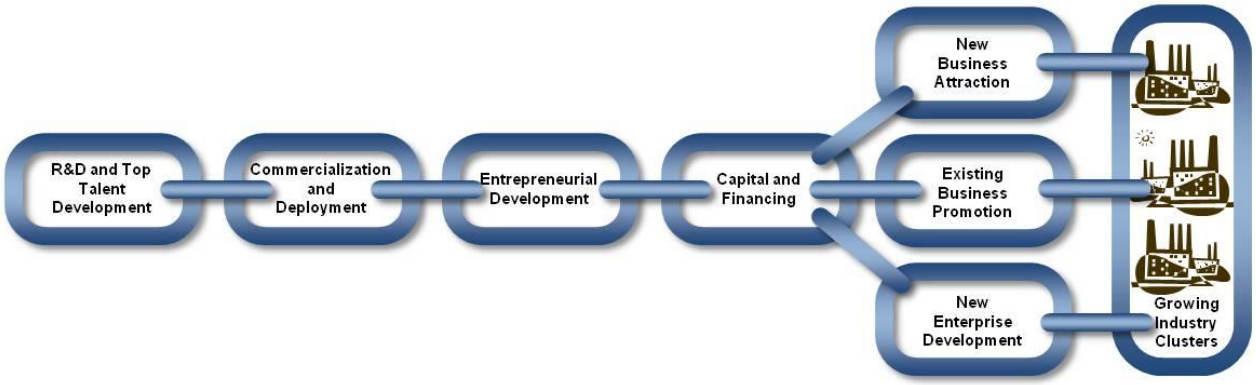
The economy of Michigan is at a crossroads—its ability to reshape itself through innovation and entrepreneurship is predicated on its ability to stay the course and continue to make significant investments to improve the entrepreneurial climate of the state. Michigan must not turn back. The time is now to seize this economic development opportunity.

Chapter 1: Introduction

The Role of Innovation in Economic Development

Economic development is not easy to achieve in general, and innovation-based economic development is an even greater challenge. The successful development of innovation into value-added products that create economic impact depend on a chain of factors that is particularly complex and challenging to develop and manage. If any link in the chain in missing, the growth potential from innovations can be held back. The states and regions in the United States that have achieved success in innovation-based economic development (places such as California and Massachusetts) have mature innovation development chains in place. These innovation development chains may form naturally over time (as occurred in Silicon Valley and Boston); or they may result from the dedicated activities of states, regions and key stakeholders to connect and build links in the chain to assure such development happens (as occurred in the Research Triangle area). Figure 1 illustrates the basic innovation development chain that needs to be in place to create and bring to market value-added innovative products and processes with the power to create significant economic impact.

Figure 1: Links in the Innovation Development Chain



Successful innovation initiatives are focused on the following:

- Assessing the potential markets for research and development (R&D)-driven capabilities and innovations against current products in the marketplace;
- Developing the product itself, and optimizing its engineering and design to meet the price points of the marketplace;
- Putting the business and management team in place; and
- Securing the sources of equity and working capital that will carry the product and/or firm through various stages of maturity until it becomes an established company/product in larger domestic and global markets.

The focus of innovation is turning research discoveries and technology advancements into firms and products with sales in the marketplace. As presented above, the development chain requires a

technological innovation as well as entrepreneurial/managerial talent and the risk capital to finance the creation of the new product or service.

About 35 percent of the companies on the Fortune 500 list are displaced every three or four years by more rapidly expanding firms. Entrepreneurs ultimately propel the country's largest businesses; they do not just run small companies.

Jeffrey A. Timmons
America's Entrepreneurial Revolution: The Demise of Brontosaurus Capitalism

Why Focus on Entrepreneurs and Entrepreneurial Companies?

Key to realizing the economic benefits of a robust innovation development chain are the entrepreneurs who can turn innovation into successful businesses. Innovation, in and of itself, will not necessarily translate into economic activity. Rather, it is the application of a technology and its introduction into the marketplace that result in economic growth.

The National Governors' Association puts forth this definition of entrepreneurship and entrepreneurs:

> *Entrepreneurship is the ability to amass the necessary resources to capitalize on new business opportunities; and an entrepreneur is one who combines smart business practices with innovation, without regard for resources under his or her control.*[2]

A number of studies and reports in recent years point to the importance of entrepreneurship in changing regional economies. Starting with David Birch's work, and validated by the Office of Advocacy of the U.S. Small Business Administration (SBA) and further refined by studies commissioned in recent years by the Kauffman Foundation and others, it is clear that technology, innovation, and entrepreneurship drive economic growth. "The large portion of entrepreneurial firms and the significant number of jobs created by smaller, newer and growing firms in the United States are a strong indication that the entrepreneurial sector, with its flexibility and capacity to adapt quickly, is poised to become an even more important protagonist in the future economic growth of the country."[3]

Entrepreneurs

- Commercialize innovative products and services that improve quality of life
- Create dynamic and flexible new industries and firms to replace those that are no longer viable in a rapidly changing global economy
- Provide most new employment opportunities
- Create wealth that is reinvested in new enterprises and, through demonstrated philanthropic activity, in communities.

Indeed, research demonstrates that entrepreneurial activity is closely tied to a state or region's level of economic growth. The Global Entrepreneurship Monitor (GEM), a leading research consortium that seeks to improve understanding of the link between entrepreneurship and national economic growth, suggests that levels

[2] *A Governor's Guide to Strengthening State Entrepreneurship Policy*, National Governors' Association, 1999.
[3] *Global Entrepreneurship Monitor: National Entrepreneurial Assessment USA 2003 Executive Report,* p. 7. See http://sites.kauffman.org/pdf/gem_2003_us_report.pdf, 11/11/04.

of entrepreneurship may account for as much as one-third of the variation in economic growth among regions, states, and nations.[4]

A report prepared for the SBA's Office of Advocacy comparing regions with strong and weak entrepreneurial activity found that "the most entrepreneurial regions had better local economies from compared to the least entrepreneurial. They had 125 percent higher employment growth, 58 percent higher wage growth and 109 percent higher productivity. This general finding held individually for large, medium and small sized regions but was most pronounced for large regions."[5]

It is important to note that, while most entrepreneurs start by forming small businesses, not all small businesses are entrepreneurial. The needs of small businesses and entrepreneurs may be similar at first during the start-up phase, but they quickly diverge as entrepreneurs focus on assembling resources and creating new innovative products or services that will lead to further investment and growth. Small business owners create companies to generate wealth and provide employment and income for themselves and others; entrepreneurs are interested in creating new innovative products or services that lead to further investment and growth.[6] Most small businesses serve a local or regional market, whereas entrepreneurial companies often are focused on the national and global marketplace.

It is also important to remember that entrepreneurship includes more than just start-ups. Mature firms must be entrepreneurial in developing new products and entering new markets. Growth and development of existing companies must be a component of any entrepreneurship strategy.

States and regions that recognize the benefits of entrepreneurship and the role it plays in today's knowledge-based economy are developing policies and programs to establish an environment that creates, attracts, and retains entrepreneurs and an infrastructure to support them. Michigan for many years has had programs in place to assist small businesses, as well as programs aimed at promoting entrepreneurship. This report focuses on the impact and effectiveness of those programs and what additional needs, if any, still exist within Michigan to foster the robust development of the innovation development chain.

Michigan's Innovation and Entrepreneurial Initiatives

The state of Michigan has committed significant resources to grow Michigan's innovative economy through the programmatic activities and investments of the Michigan Strategic Fund (MSF) since 1984. In 2005, the MSF's enabling legislation was modified (Act 215, P.A. 2005 and related legislation) to create the 21st Century Jobs Trust Fund program with appropriations and proceeds from the state's portion of the tobacco settlement revenue. The goal of this program and its components are to make investments and award grants and loans to help diversify the economy of the state, to help create jobs, and to provide for economic development.[7]

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[4] *Global Entrepreneurship Monitor 1999 Executive Report,* p. 18.

[5] *The Innovation-Entrepreneurship Nexus: A National Assessment of Entrepreneurship and Regional Economic Growth and Development*. Powell, Ohio: Advanced Research Technologies, LLC, April 2005, p. 5.

[6] Thom Rubel and Scott Palladino, *Nurturing Entrepreneurial Growth in State Economies*. Washington, DC: National Governors' Association, 2000.

[7] From 21st Century Jobs Trust Fund Program annual reports and Michigan Senate Fiscal Agency, *State Notes*.

Since the 21st Century Jobs Trust Fund Initiative (or the 21st Century Jobs Fund or 21st CJF) was created in 2005, $261.6 million has been invested in innovation and entrepreneurship efforts across Michigan through efforts to do the following:[8]

- ***Catalyze the growth of technology start-up companies***, including funding for entrepreneurial support services and entrepreneurial service providers ranging from public providers such as the Small Business Development Center (SBDC) Tech Team to private consultants such as the Biotechnology Business Consultants. Additional funding is also provided for the Business Accelerator Fund (BAF), managed by participating business accelerators and SmartZones (intermediary organizations) statewide to provide specialized business acceleration services and resources (e.g., small catalyzing investments).
- ***Increase the availability of risk capital***, including programs such as the Early Stage Funding Program—providing pre-seed (and microloan) funds managed by intermediary organizations that are closer to the entrepreneurs to make direct investment in new start-up activities; the Pure Michigan Venture Match Fund—that matches venture capital investments made to promising, nationally competitive firms; the Pure Michigan Venture Development Fund—providing funds to leverage the establishment of Michigan-based venture capital funds; and the 21st Century Investment Fund—providing direct investments in existing venture capital funds to provide increased leverage and focus to Michigan-based opportunities and investments.
- ***Foster the commercialization of new products, processes, and services***, including programs such as: the Emerging Technologies Fund (ETF)—that provides matching funds for awarded Phase I or II federal Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) projects; the Michigan Translational Research and Commercialization (MTRAC) program—providing leveraged support for the translation of university research into new products and start-ups; and Michigan University Technology Acceleration and Commercialization (UTAC) program—designed to facilitate partnerships between the state's universities and the private sector to accelerate the commercialization of university technologies and intellectual property (IP).

Study Charge and Report Outline

To ascertain whether or not Michigan's Innovation and Entrepreneurship Programmatic Investments have effectively helped to increase the likelihood of impactful innovations making it to the market through entrepreneurial endeavors, it is important to understand the direct and indirect economic impacts of the innovation/entrepreneurial programs funded by the state of Michigan and to examine how the a is functioning in aggregate, as well as where there are real strengths and weaknesses within the innovation chain. Such an analysis will then help to inform future investment decisions based on existing opportunities.

To better understand the impact of the 21st CJF to date as well as the current environment for entrepreneurs in Michigan and the state of the infrastructure in place to assist them as they grow, the Michigan Economic Development Corporation (MEDC) engaged Battelle Technology Partnership Practice

[8] Since inception, the 21st Century Jobs Trust Fund has invested $268.7 million in innovation and entrepreneurship programs with $7.1 million returned for a net investment of $261.6 million. Source: 21st Century Jobs Trust Fund Annual Report: FY 2014.

(TTP) in the spring of 2015 to conduct an assessment of Michigan's innovation and entrepreneurial support infrastructure. The Battelle team undertook a quantitative analysis of the impacts of the investments to date as well as interviewed entrepreneurs and service providers to obtain their input on the challenges facing entrepreneurs in the state and to discuss gaps in services and how they might be addressed. The findings from these analyses were provided to MEDC in PowerPoint formats through the summer and early fall of 2015. The final report was never completed as the project was put on hold while internal decisions within MEDC were made. At the point when MEDC was ready to resume work on the effort, Battelle TTP was no longer in existence. At that time, MEDC approached TEConomy Partners, LLC to undertake the conclusion of the work.

TEConomy Partners, LLC was formed in the fourth quarter of 2015 as an independent company, transitioning the complete staff and capabilities of TPP from Battelle Memorial Institute. TEConomy Partners is a comprehensive, technology-based, economic-development consulting group whose principals have a 25-year track record in developing core competency analyses, strategic plans, national thought-pieces, and implementation strategies for industry associations, state and local governments, universities and university research park developments, business development groups, and foundations around the world. The expert team at TEConomy works extensively with clients in the United States and internationally to assess scientific and technological capabilities and to translate them into technology platforms linked with market opportunities. The team also sustains an intensive practice in economic analytics and regularly applies this expertise in performance of economic and functional impact analysis for government, higher-education institutions, academic medical centers, industry and related associations, and other client groups. Active in both domestic and international markets, the TEConomy team has performed projects in almost every U.S. state and has performed numerous international projects.

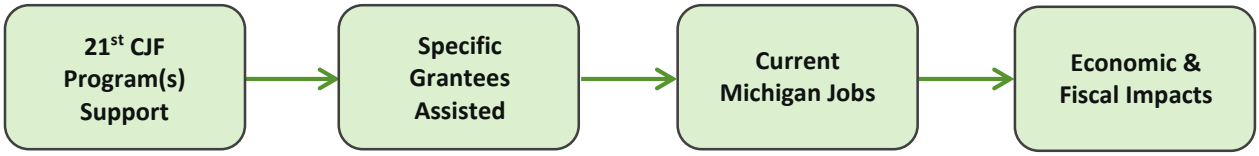
This report completes the work begun by Battelle TTP by utilizing the previously developed quantitative and qualitative analyses and developing the final report based on the previous work conducted. It is organized into the following sections:

- **Chapter 2:** Economic Impact Analysis. Discussion of the IMPLAN input/output findings that examined the economic impact of the 10-year 21st CJF Initiative on Michigan's economy today and analysis of the portfolio's return on investment (ROI).
- **Chapter 3:** Benchmarking Analysis. Discussion of how Michigan compares with a set of benchmark states across a number of measures that assesses the state's innovation/entrepreneurial ecosystem.
- **Chapter 4:** Situational Analysis. Discussion of the current status of Michigan's innovation/entrepreneurial ecosystem focusing on existing strengths that can be leveraged and additional gaps that could be filled through programmatic investment.
- **Chapter 5:** Strategic Recommendations. Based on the findings, suggested strategies and actions that MEDC should pursue to strengthen Michigan's innovation/entrepreneurial ecosystem in the future.
- **Chapter 6:** Conclusion.

Chapter 2: Economic Impact Analysis

Economic impact analysis is an approach to estimate and quantify the jobs and job creation, related personal income, business sales (output), and the tax revenues associated with these incomes and sales, typically as part of a "stimulus" to a regional economy. These impacts are measured using the well-established regional-economic analysis technique of input/output (I/O) analysis, which tracks the revenues of a sector and the related economic activity of suppliers to the sector and its personnel. This particular analysis quantifies the current (2014) economic impacts of the total investment and funding programs within the Michigan's 21st CJF through 2014—as represented and measured by the employment of those firms receiving support or assistance from these programs (Figure 2). It is important to note that, out of necessity for data collection and development, it is assumed that these programs have supported all the employment within these firms. The impacts on the state of Michigan estimated in this analysis include output, jobs, personal income, and state and local taxes. Once these total impacts are estimated, an overall ROI for the state of Michigan is also calculated.

Figure 2. Program Support Leading to Economic Impact



Methodology and Data Inputs to the Impact Analysis

The core data for this overall impact analysis includes three components:

1. programmatic investment information;
2. a listing of the companies receiving direct financial support and/or assistance from financially supported intermediaries; and
3. company-specific employment information for 2014.

The core programmatic investment information of the 21st CJF was provided by the MEDC in both summary form and via annual reports. The information regarding companies that received assistance was provided either by MEDC, for direct investment activities, or by intermediary organizations that provided client information under the auspices of nondisclosure agreements with the TEConomy Partners' principals. In most instances, estimates of the 2014 employment of these companies were provided by the various service providers, typically developed using either survey or follow-up interviews. When an employment figure was not provided for a specific company, Dun & Bradstreet data services and/or web-based information was used either to establish a 2014 employment value or to confirm that the company ceased operations by 2014. Additionally, information from MEDC, service providers, and Dun & Bradstreet was used to classify the companies into one of six "industry" groups, and in some instances further subgroups, for added analytic specificity.

Key Data Cleaning and Coding Considerations

In developing the input data for this impact analysis, a number of data cleaning steps and data coding considerations had to be made, including the following:

- Company "records" were received from MEDC and various intermediary agencies. Inconsistencies within these records required development of a consistent, single-company record dataset for nearly 1,400 "firms."
    - Records received from intermediaries included 167 firms either specifically identified as or determined to be "not yet in business" (and hence employment data often does not exist). However, investments made to these companies are included in the sector programmatic investment figures and ROI calculations as appropriate.
    - Records for firms receiving investments from 21st CJF-funded Venture Capital firms were also obtained from Thomson Reuters Thomson ONE venture-capital analysis database.
    - Firms funded or supported by 21st CJF funds that had left the state prior to 2014 were not included in the analysis.
- **In total, 1,073 Michigan firms with a combined employment of 11,006 were included in the impact analysis.**
- Two key investment targets of MEDC/21st CJF—Energy and Homeland Security—do not lend themselves to a distinct North American Industry Classification System (NAICS)-based industry analysis (e.g., energy firms could be in ethanol [agbioscience] or solar photovoltaics [advanced manufacturing—electronics and instruments]) and were therefore classified based upon their industry sector.
- Analysis is based on firms that have a verifiable Michigan location. Student-based "start-ups" that are established in the students' home (non-Michigan) states are not included.
- Determination was made whether the company was actually "manufacturing" the product/technology in 2014. If evidence suggested that the company was still developing the product or technology, the company is treated as an R&D or service-related technology company as appropriate. This is an important recognition and distinction as supply-chain concepts embedded within the I/O impact model are distinctly different between actual manufacturing firms and firms engaged in R&D or design.
- Technology-oriented firms with less than 10 employees, with limited additional information, are included in the R&D, Engineering, and Technical Services sector.
- Firms are categorized into the most appropriate sector for IMPLAN modeling purposes based upon the "function" of the firm. For example:
    - Firms developing online apps related to restaurants or retail were classified as Information Technology (including Software as a Service) (IT/SaaS) firms, not consumer/retail firms. Similarly, health-care and biomedical-related IT firms are also classified as IT/SaaS.
    - If determination cannot be made regarding the technology or sector orientation of a firm, then it is modeled within one of the subcomponents of the Business, Consumer, and Retail Services group as most appropriate.

A key data-development consideration in this analysis is to determine the industrial sector that best fits each of the firms receiving 21st CJF support (see also Key Data Cleaning and Coding Considerations). Given the level of detail available on each of these firms, issues concerning the sector identification that was provided with the raw data, and the requirements related to stage of production and potential supply chains to these companies and the effects this has on measuring impacts, it was determined that the best modeling approach was to reclassify each firm to the most appropriate sector level possible. To enable both the overall economic impact modeling and an industry portfolio-based examination, each of the 1,073 supported companies were classified into one of six broad sectors, and for two sectors—Advanced Manufacturing and Life Sciences—further classified into specific subsectors. Within the IMPLAN model, these broad sectors and specific subsectors are modeled through a developed aggregation scheme to best match the appropriate sector. For example, available information and web research may easily identify a firm as an automotive supplier, but may not have been detailed enough to determine which one of the many motor vehicles manufacturing–related NAICS codes to specifically classify the firm. In this context, an aggregated "automotive" sector within the IMPLAN model was developed and used to model all of these automotive-related firms. These broad and subsector classifications were then used to segment the model input data for an overall economic-impact analysis and to also examine the role industry sector plays in level of impact.

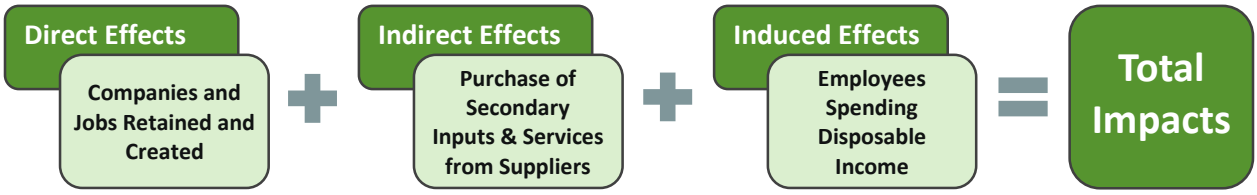
Measuring Economic Impacts

This economic impact analysis uses a Michigan-specific IMPLAN I/O model, from the IMPLAN Group, LLC, quantifying the interrelationships between economic sectors in the economy of Michigan. The IMPLAN models are the most widely used models in the nation and are based on a number of federal datasets, including data from the U.S. Bureau of Economic Analysis (BEA) and the U.S. Bureau of Labor Statistics. The model's data matrices track the flow of commodities to industries from producers and institutional consumers within the nation. The data also model consumption activities by workers, owners of capital, and imports. The interindustry trade flows built into the model permit estimating the effects of one sector on all other sectors with which it interacts. For this analysis, the use of a Michigan-specific model captures only those economic activities expected to occur within Michigan as part of these estimated effects. For example, purchases from non-Michigan suppliers are treated as an "import" to the state of Michigan and are therefore excluded from the Michigan impacts.

Economic impacts consist of three types: ***direct effects*** (the specific effects of the companies and sector[s] in question), ***indirect effects*** (the effects on suppliers to the focus industry), and ***induced effects*** (the additional economic effects of the spending of these suppliers and employees in the overall economy). Taken together, these three impact effects combine to form the ***total impacts*** (summarized in Figure 3). Impact analysis measures the estimated expenditures of companies and sector(s) in the economy, the flows of these expenditures through industry suppliers, the ongoing re-spending of these dollars by the suppliers buying additional inputs, and the effects of workers spending their wages throughout the state and U.S. economy. This ***"multiplier"*** effect represents the concept that every dollar spent in the economy may be partially re-spent (or recirculated) in the economy through purchases or wages, thereby generating additional economic activity and impact. I/O analysis represents the generally accepted standard for measurement of economic impacts. Multipliers, as presented in the

following tables, include the direct effects; so, for example, an employment multiplier of 2.15 indicates that, for every one direct job, an additional 1.15 jobs are created within the regional economy.

Figure 3. Components of Total Impacts



Specifically, the analysis included in this report measures the total economic activity of the year 2014 connected to the Michigan firms that received some level of financial or consultative support from the 21st CJF from MEDC or an intermediary organization during its 10 years of operations—2005–2014. Due to issues of data availability, comparability, and quality, this analysis does not develop a cumulative total impact assessment (e.g., measuring impacts for each of the 10 years of the Jobs Fund). Again, this analysis makes the implicit assumption that all measured employment is "connected" to this support and excludes firms that received support during the 10 years, but did not have any 2014 employment (by the fact that they contribute 0 employees to total sector employment). However, for ROI calculations, any 21st CJF investments made directly or in support of these firms are included in the total investments.

The IMPLAN model was used to estimate four types of impacts for this effort:

- Employment is used to drive the overall impact modeling (direct effect employment) based on information provided for and developed by this analysis. The model estimates the total number of jobs created on a headcount—not full time equivalent (FTE)—basis;
- Labor Income is the total amount of income, including salaries, wages, and all benefits, received by workers in the economy including sole proprietors;
- Output, also known as business volume, is the total value of goods and services produced in the economy; and
- State and Local Revenues includes the estimated revenues of state and local governments from all sources as a result of the impacts estimated.

These impact estimates are developed within the structure and function of the IMPLAN model for the state of Michigan and are based upon the sector-specific information contained within the model. As the performance data on these firms was limited to employment, either provided or developed through additional research, specificity regarding wages earned, specific sales or revenue levels, or taxes paid were unavailable, and hence, completely estimated through the model.[9] The estimates developed and provided herein provide guidance and perspective as to the performance potential of the companies within the 21st CJF portfolio.

[9] It is important to recognize that current MEDC and intermediary organization data-collection efforts regarding portfolio companies do not broadly include specific and/or consistent sales or revenue information. Hence, output estimation is built completely on industry norms as captured within the Michigan 2014 IMPLAN model.

Economic Impact and ROI Results

Since the 21st CJF started to provide entrepreneurship and innovation assistance in 2004, Michigan has assisted nearly 1,400 companies and new entrepreneurial start-ups—either directly or through service intermediaries. Of those, 1,073 companies were actively operating in Michigan in 2014 and form the basis for this economic impact analysis.

Economic Impact—2014

Together, these companies directly employed more than 11,000 workers in 2014, with estimated wages and benefits of nearly $879.5 million (Table 1). The direct effect of these workers is estimated to generate $3.2 billion in output and, in turn, support nearly $48.4 million in state and local tax revenue.

Table 1. Total Economic Impact of 21st CJF Portfolio Companies, 2014

Impact Type	Employment	Labor Income	Output	State & Local Revenue
Direct Effect	11,006	$879,456,355	$3,226,910,706	$48,378,896
Indirect Effect	7,516	$419,102,077	$1,228,406,408	$53,914,134
Induced Effect	8,316	$341,009,126	$1,047,846,068	$63,193,825
Total Impacts	**26,839**	**$1,639,567,559**	**$5,503,163,182**	**$165,486,851**
Multiplier	*2.44*	*1.86*	*1.71*	

Source: Analysis using 2014 IMPLAN State of Michigan impact model.

The indirect effects in turn generate an additional $1.2 billion in output from supplier firms and support an additional 7,500 Michigan jobs. When combined with the additional induced effects of worker spending throughout the Michigan economy, the estimated total impacts of the companies receiving 21st CJF support reaches more than 26,800 jobs (for a multiplier of 2.44), $1.6 billion in total labor income, as part of total output impacts of more than $5.5 billion. Together, this employment, income, and output generate nearly $165.5 million in state and local tax revenue.

Return on Investment—2014

Since its inception, the Michigan 21st CJF has invested $268.7 million in innovation and entrepreneurship programs. As with all such programs, due to varying circumstances, approximately $7.1 million was returned to the Jobs Fund, leaving a net investment in direct support or of intermediary organizations of $261.6 million over the 10-year, 2005–2014 period.[10] This figure becomes the comparative basis for all ROI discussion. It is important to note, as in all single-year "snapshot" analyses, the results of today required investment within the 21st CJF over the course of these 10 years. Though these impacts and resulting ROI estimates are developed for the year 2014, both investment and returns occurred prior to 2014 and, by their continued existence, these firms will provide additional returns to the state after 2014.

[10] Michigan 21st Century Jobs Trust Fund Report: FY 2014. Expenditure data are included only for the Innovation and Entrepreneurship Program Portfolio.

Economic Output ROI

Shown in Table 1, as of 2014, the 1,073 companies supported by 21st CJF investments were estimated to be generating $5.5 billion in annual output or business volume. At this level, every $1.00 in *cumulative* 21st CJF investment leverages additional private-sector innovation, operations, and capacity, resulting in $21.00 of total *annual* economic output for the state of Michigan. This indicates that these investments and initiatives have indeed spurred significant economic activity in the state.

Tax Revenue ROI

From a purely state investment and revenue perspective, these companies, their suppliers, and their workers are estimated to have generated more than $165 million in state and local tax revenues through their 2014 operations. This one-year value alone represents 63.3 percent of the cumulative 10-year 21st CJF investments. Examined differently, if these cumulative investments are annualized over the 10-year period, yielding an annual average investment level of $26.16 million, these annual state and local tax revenues greatly exceed this level of investment. Under this approach, $6.33 is returned in state and local taxes in 2014 for every $1.00 of annualized 21st CJF investment.

Industry Portfolio-Based Examination

To provide further insights into the role that the 21st CJF investments have had on the growth and development of the Michigan economy, economic impact analyses were also performed on a sector and subsector basis. These analyses provide context into how decisions regarding "target or focus industries" can yield differential impacts. This type of analysis, however, must also take into consideration how much variation can exist between industries and different sectors of the economy regarding "product-to-market" or life-cycle issues. For example, the typical development horizon is much shorter for the IT industry and in the retail space—as customer/consumer demands dictate the required development pace of the firms. Most of manufacturing has a somewhat longer time horizon for getting products to market; but, even for these firms, this time is continually pushed to be a year or less. Finally, by its intrinsic nature and applications to human health, much of the life sciences industry, especially biomedical sectors, have a much longer development path. Biomedical products typically go through months, if not years, of testing, clinical trials, and approvals before they ever reach the market to generate sales from consumers. Furthermore, many, if not most, of these development efforts fail or are abandoned when the product under development does not meet specific performance milestones or efficacy criteria or ultimately are denied by federal regulators. This variation is a key driver for including many early-stage technology firms in the R&D, Engineering, and Technical Services sector as the output (sales) and supply-chain characteristics of these firms are substantially different from fully operational manufacturing.[11]

A key differential exists in the estimations of ROI for these specific industry sectors. To more precisely capture and link these impacts and ROI to the sectors, this metric includes only company-specific investments (either directly or through intermediaries such as the BAF) in the investment summary. Programmatic supporting investments to intermediary organizations are not included in these company-

[11] As stated previously, if it could not be substantiated that actual products were being sold/shipped, the firm was likely classified into the R&D, Engineering, and Technical Services sector.

specific net investments. However, the total employment used is the total employment of all the companies in the developed database whether or not they were a direct financial recipient.

Table 2 summarizes the direct employment for each sector's companies, the net company-specific investment into companies within each sector, and the estimated total impacts generated by these companies in terms of employment, labor income, output, and state and local tax revenue generated.

As shown in Table 2, the Advanced Manufacturing sector has the largest 2014 employment at nearly 3,900 jobs. The Life Sciences sector, the second largest employment sector, received the largest amount of specific investment, accounting for $86 million, or slightly more than half, of all company-specific investments. These sector-specific impact estimations provide some context as to the potential impacts to be expected from these companies. The most significant finding of the industry portfolio-based analysis is that estimated state and local tax for just 2014 exceeds the net, cumulative 21st CJF industry-specific investment in four of the five sectors. The extended product-development time horizons, inherent in R&D-related firms in both the Life Sciences and R&D, Engineering, and Technical Services sectors, can be seen in lower comparative levels of state and local tax revenues. **It is important to note, that, while model-based estimates, these results compare a *single year's* impacts (2014) with the *cumulative* industry portfolio investments.** Obviously, impacts have been generated within the state prior to 2014 by those firms in existence, and these impacts will continue and expand as these firms grow, bring additional products to market, and generate additional sales from their Michigan operations.

Table 2. Total Economic Impacts of 21st CJF Portfolio Companies, 2014[12]

Sector	Direct Effects		Company-Specific 21st CJF Net Investments	Total Impacts			
	# of Portfolio Companies	Employment		Employment	Labor Income	Output	State & Local Tax Revenue
Advanced Manufacturing	198	3,896	$43,543,461	9,573	$594,305,516	$2,553,249,604	$65,051,994
Life Sciences	222	2,412	$86,009,672	6,778	$439,862,591	$1,479,858,153	$42,598,618
Information Technology (IT/SaaS)	311	2,350	$18,654,198	5,661	$342,863,008	$808,068,103	$31,189,607
R&D, Engineering, and Technical Services	204	1,572	$17,421,643	3,597	$214,761,603	$510,609,757	$17,995,519
Business, Consumer, & Retail Services	137	773	$1,749,410	1,222	$47,123,286	$147,468,074	$8,494,943

Source: Analysis using 2014 IMPLAN State of Michigan impact model.

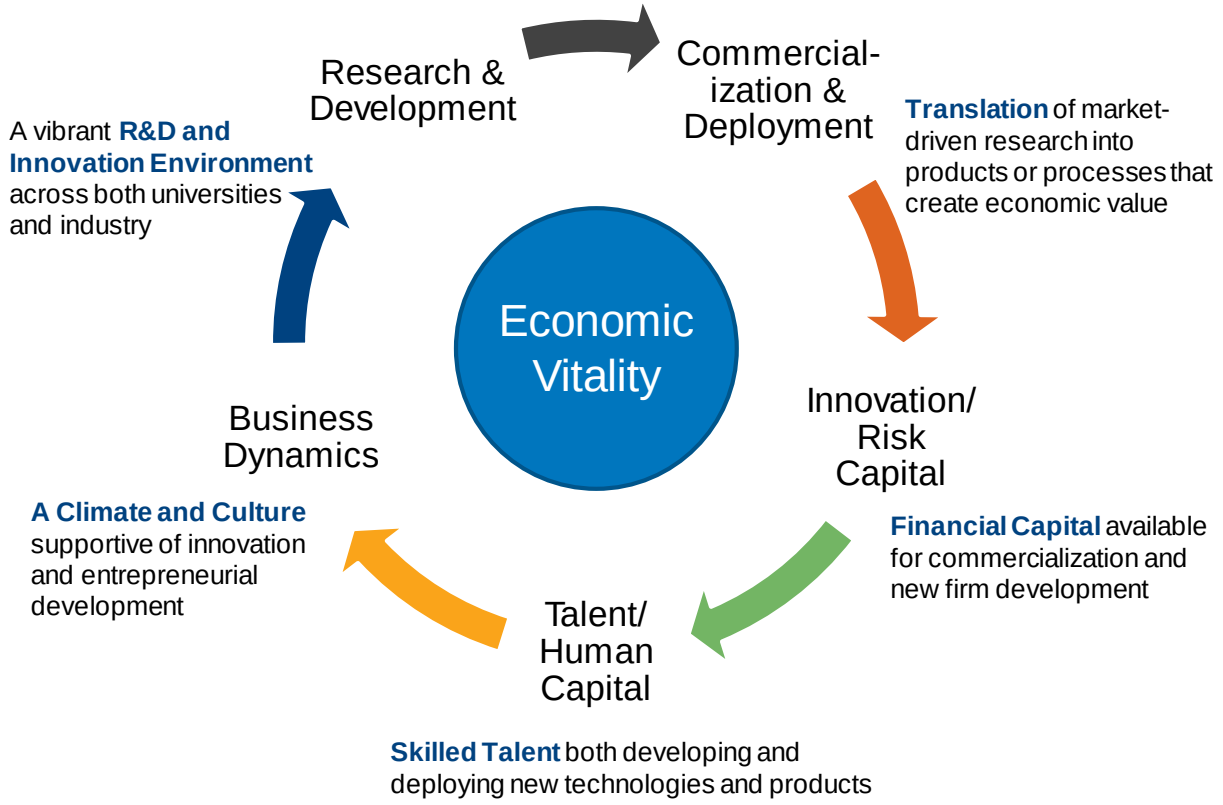
[12] In addition to the 1,072 firms shown in Table 2, there was one additional firm that fell outside of these five broad categories and was modeled in its own specific sector as part of the total statewide analysis.

Chapter 3: Benchmarking Analysis

The Innovation/Entrepreneurial Ecosystem

For innovation and entrepreneurship to thrive within a region, an entire interconnected sequence of positive factors, or what TEConomy terms the innovation/entrepreneurial ecosystem, has to be in place that connects and strengthens the drivers of business growth and development. If components in the ecosystem either inadequately address economic needs or are missing altogether, a sustainable value-added economic base able to generate quality jobs and impact economic vitality with a state is unlikely to develop (Figure 4).

Figure 4. Components of a Robust Innovation/Entrepreneurial Ecosystem that has the Capacity to Impact the Economic Vitality of a State



When the nation's premier economic centers of innovation and entrepreneurship are examined, it quickly becomes apparent that a number of common elements have enabled these regions to succeed in growing their start-up base. Elements within a holistic innovation and entrepreneurial ecosystem include the following:

- **Research and development—**the capacity of a region's R&D organizations to conduct cutting-edge research combined with the desire to see that research applied to solve real-world problems. Indications of the presence of the element within a region include the following:

- Access to a strong, world-class higher-education presence and/or discretionary federal research funding support
- Cutting-edge technology firms, with leading-edge researchers and clinicians advancing in a multidisciplinary approach areas of technology that align with industrial interest.

- **Commercialization and deployment**—the capacity to streamline and accelerate the process by which market-driven research is translated into products or processes that create economic value. Indications of the presence of the element within a region include the following:
  - Accelerated translational pathways that bring discoveries into commercial or societal use
  - Translation of market-driven research into products or processes that create economic value
  - An environment that understands that economic impact is the result of innovation, which is inclusive of both invention and commercialization, not solely idea creation
  - Rampant collaboration/networking, an inherent environment that fosters synergies and connections that add value to the innovation model.

- **Innovation/risk capital**—the availability of requisite capital to finance high-risk, high-growth entrepreneurial endeavors. Indications of the presence of the element within a region include the following:
  - Access to various forms of financial capital throughout the entire business-development life cycle, including angels, pre-seed funds, seed funds, venture capital funds, and venture debt/venture lending organizations
  - Investment capital available from trusted financial markets with fair financial valuations based on realistic expectations on both sides of the transaction.

Key Elements of a Robust Innovation/Entrepreneurial Ecosystem

- Research and Development
- Commercialization and Deployment
- Innovation/Risk Capital
- Access to Talent/Human Capital
- Positive Business Dynamics

- **Access to talent/human capital**—the availability of individuals with the accumulated knowledge and skills that make a workforce innovative and entrepreneurial. The presence of the element requires the following attributes:
  - Presence of entrepreneurial talent, including serial entrepreneurs
  - Proliferation of spillovers or spin-offs from regional innovation anchors
  - Positive migration dynamics of highly skilled, knowledgeable individuals who are interested in innovation and entrepreneurial endeavors
  - Educational/training systems that incorporate a relevant, high-quality curriculum that is responsive to business needs, includes relevant entrepreneurial components and real-world experiences, and is readily available

- **Positive business dynamics**—the presence of a business climate that fosters the growth of innovative companies. Indications of the presence of the element include the following:

- Development being viewed holistically with every component of the innovation/entrepreneurship ecosystem being addressed
- Collaborative relationships between government, academia, and industry
- A positive business climate that allows for ease of registration/doing business.

It is important to note that these elements are not independent of one another; but, in fact, the success of catalytic initiatives in one component of the innovation/entrepreneurial ecosystem is strongly correlated to the success of catalytic initiatives in another component of the ecosystem.

The value of developing a robust innovation and entrepreneurial ecosystem is that it will spur growth and competitive advantage within a state/region. Economic gains that are achieved when a robust, proactive action plan for fostering innovation and entrepreneurial growth is implemented include the following:

- Rising productivity of companies, creating a competitive advantage for the region
- Accelerated development of new products and processes, helping to ensure global competitiveness
- Increased frequency of new start-ups with high-growth business potential
- Stronger supplier networks, increasing the economic multiplier impact of the value chain for the region
- Larger pools of specialized workers and education and training programs, introducing significant cost savings for firms and increasing the breadth and depth of employment opportunities for workers in the region
- Increased quality of life for the region's citizens.

The bottom line is that states and regions that have strategically focused on creating a holistic, well-functioning innovation and entrepreneurial ecosystem are prospering in the 21st Century.

Benchmarking Methodology

Why Benchmark Ecosystem Metrics?

The general purpose of any benchmarking exercise is to identify, analyze, and draw useful lessons from the practices of states that are generally comparable along relevant strategic dimensions. Additional specific goals are to:

- Learn where you stand—analyze where you stand today across the various components of the ecosystem and how you have evolved over time
- Identify your competition—analyze how competitor states are doing by comparison across the various components of the ecosystem
- Isolate the strategic issues—determine whether or not there are components of the ecosystem for which you have comparative strengths and/or weaknesses.

Selecting Benchmark States

In consultation with MEDC, Battelle developed a set of 12 comparison states to benchmark and assess Michigan's current position and recent progress in advancing its innovation and entrepreneurial ecosystem. States were chosen from the following:

- States that are viewed as regional competitors and represent economies similar in composition and/or size to Michigan (Illinois, Indiana, Tennessee, Minnesota, and Wisconsin)
- States that have made long-term investments in entrepreneurial and innovation programs and initiatives in an effort to grow their economic base (Arizona, Connecticut, Georgia, Maryland, and Texas)
- States that are both regional competitors and programmatic investors (Ohio and Pennsylvania).

The following narrative provides the results of the benchmarking analysis across numerous metrics found within the innovation and entrepreneurial ecosystem.

Research and Development

Industry and university-based R&D are key building blocks to innovation in an economy and can help attract much-needed capital and a talented workforce. Industry-funded university R&D is especially valuable since those initiatives can lead to innovations that have high market potential.

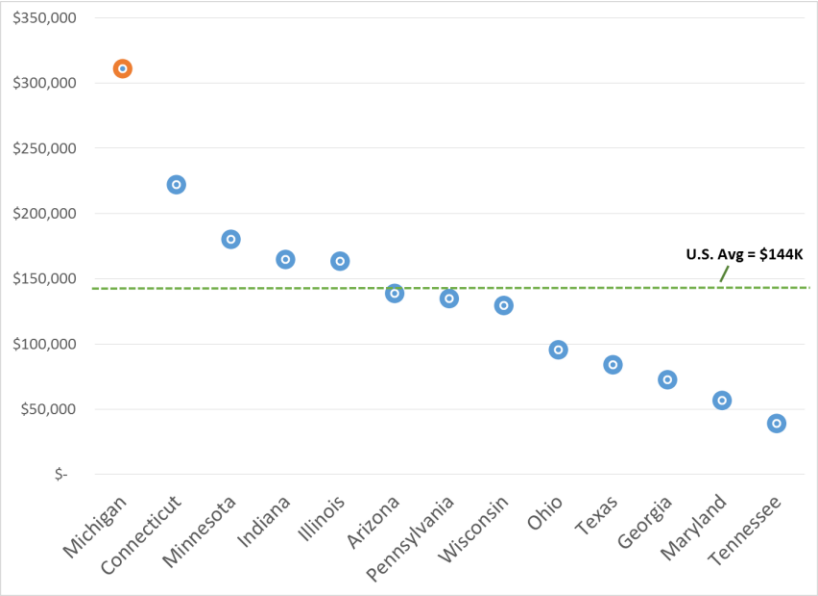
Michigan stands as a leader among the benchmark states in both industrial and university R&D. In 2012, the state's industrial R&D per $10 million gross state product (GSP) was the highest among the benchmark states at slightly more than $311,000, well surpassing the U.S. average of about $144,000 (Table 3, Figure 5). Growth in this area has not kept pace with the nation, however. From 2004 to 2012, industrial R&D in Michigan contracted by 11 percent, whereas the nation grew by 15 percent. The state's negative growth in industrial R&D placed the state 10th among the benchmarks.

Table 3. Research and Development in Michigan

Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
Industrial R&D	Industry R&D Expenditures per $10M GSP, 2012	$311,161	$143,615	1st
	Percent Change, 2004–12	−11%	15%	10th
University R&D	University R&D Expenditures per $10M GSP, 2013	$49,335	$37,866	3rd
	Percent Change, 2004–13	53%	47%	6th
Industry-Funded University R&D	Business-financed University R&D per $10M GSP, 2013	$1,610	$2,049	9th
	Percent Change, 2004–13	13%	61%	10th

Sources: National Science Foundation, Higher Education Research and Development Survey, 2013, and Business R&D and Innovation Survey, 2012.

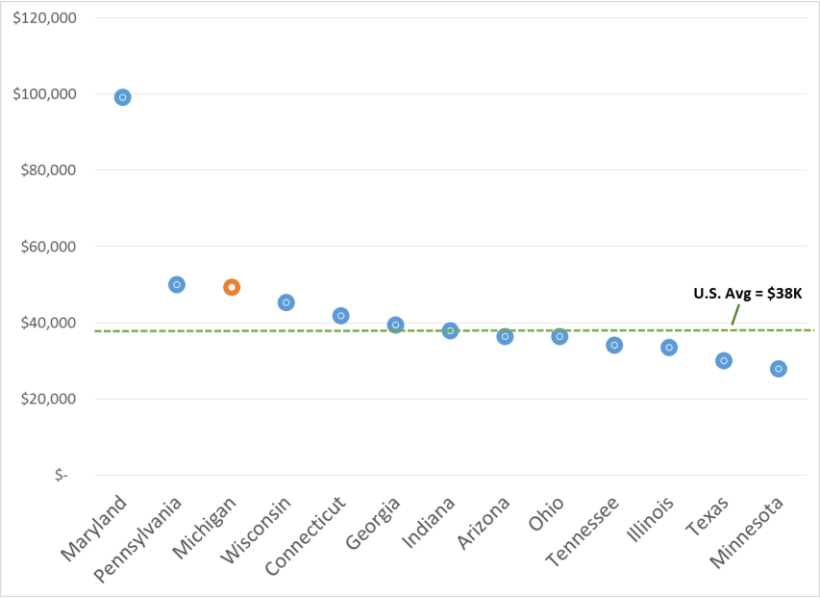
Figure 5: Industrial R&D per $10M GSP, 2012



Source: National Science Foundation, Business R&D and Innovation Survey, 2012.

Michigan's academic R&D per $10 million GSP was ranked third among the benchmarks in 2013 and exceeded the U.S. average at slightly more than $49,000 (Figure 6). Growth in Michigan's academic R&D from 2004 to 2013 reached 53 percent, higher than the national increase of 47 percent and ranking the state sixth in growth among the benchmarks. On their own, Michigan's industry and academic institutions are engaging in significant amounts of research, although growth in these research areas needs to be bolstered if it is to reach the levels achieved by the leading benchmark states.

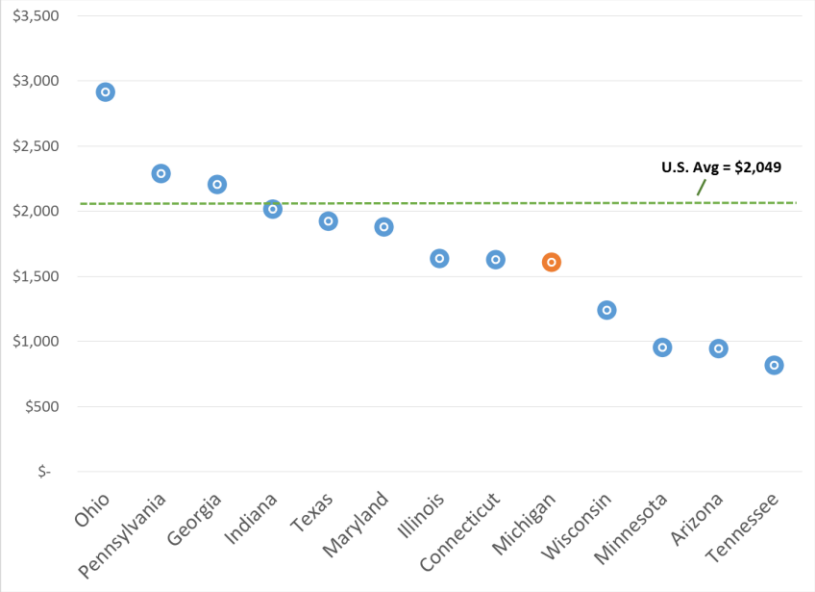
Figure 6. Academic R&D per $10M GSP, 2013



Source: National Science Foundation, Business R&D and Innovation Survey, 2012

Troubling signs appear when analyzing the relationship between industry and university research. Michigan ranked ninth among the benchmarks in business-financed university R&D per $10 million GSP in 2013 and also falls below the national average (Figure 7). Growth in this area also lags both the benchmarks and the United States, with Michigan being ranked 10th among the benchmarks at 13 percent, falling significantly below the national increase of 61 percent over the 2004-to-2013 period.

Figure 7. Industry-funded University R&D per $10M GSP, 2013



Source: National Science Foundation, Higher Education Research and Development Survey, 2013.

Overall, while Michigan's standing among the benchmarks with regard to R&D is still strong, there are indications that this strength may be waning, and the state could lose ground to its competitors because of a lack of connection between industry and academia.

Commercialization and Deployment

Universities licensing their IP is one way for institutions to generate income from their innovative efforts and can impact the local economy through the creation of spin-off companies. These technology transfer metrics are a good proxy for measuring the innovation of a region's academic institutions. Over the 2011-to-2013 period, Michigan universities issued an average of 0.81 licenses per $10 million in university research spending, placing it seventh among the benchmarks and falling below the national level of 0.99 licenses (Table 4). The same is true of Michigan's annual income from those licenses, which ranked ninth among the benchmarks at $92,510 per $10 million in university research spending. University start-up creation in Michigan also fell behind most benchmarks and the United States, with the state averaging 16 start-ups over the 2011-to-2013 period, placing it eighth among the benchmarks. Compared with the nation, Michigan's universities created 0.08 start-ups per $10 million in university research from 2011 to 2013, below the national average of 0.12.

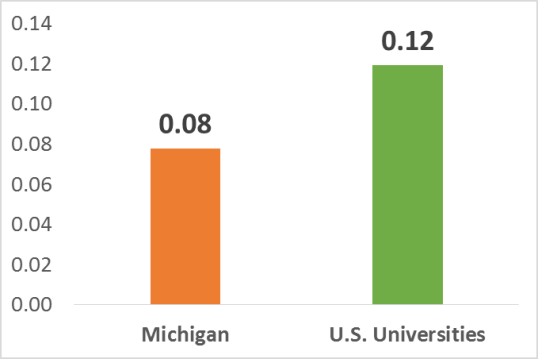
Table 4. Commercialization and Deployment in Michigan

Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
University Technology Transfer & Commercialization	Avg. Annual Univ. Start-ups, 2011–13	16	668 total/ 4.3 per Univ.	8th
	Change in Start-ups, Avg. 2004-06 to 2011–13	−2	238 total/ 1.5 per Univ.	13th
	Avg. Licenses Issued per $10M Univ. Research, 2011–13	0.81	0.99	7th
	Avg. Annual License Income per $10M in Univ. Research, 2011–13	$92,510	$345,570	9th
Patenting (All patents, including Industry & Universities)	Invented Patents per $100M GSP, 2014	1.6	1.0	2nd
	Percent Change, 2004–14	49%	69%	11th

Sources: Association of University Technology Managers, Licensing Survey, 2013, and Thomson Reuters Thomson Innovation patent analysis database.

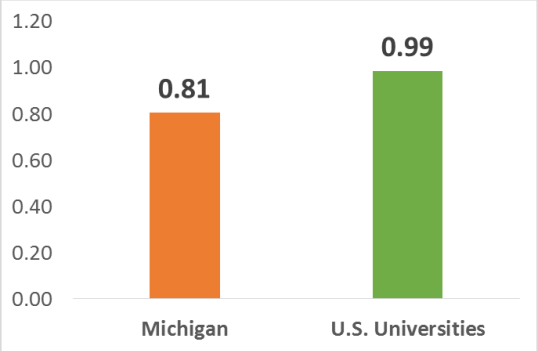
Michigan has not seen significant growth in university start-up activity over time compared with the nation or the majority of the benchmark states. The annual change in start-up creation was −2 for Michigan when comparing the 2004-to-2006 period with the 2011-to-2013 period. This placed the state last among the benchmarks and below the national rate. Overall, Michigan lags the nation and the majority of the benchmarks in technology transfer measures (Figures 8, 9, and 10).

Figure 8. University Licenses and Options Executed per $10M Univ. R&D, Avg. 2011–13



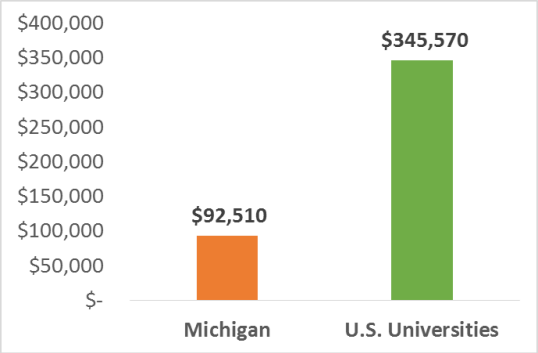
Source: Association of University Technology Managers, Licensing Survey, 2013.

Figure 9. Licenses and Options Executed per $10M Univ. R&D, Avg. 2011–13



Source: Association of University Technology Managers, Licensing Survey, 2013.

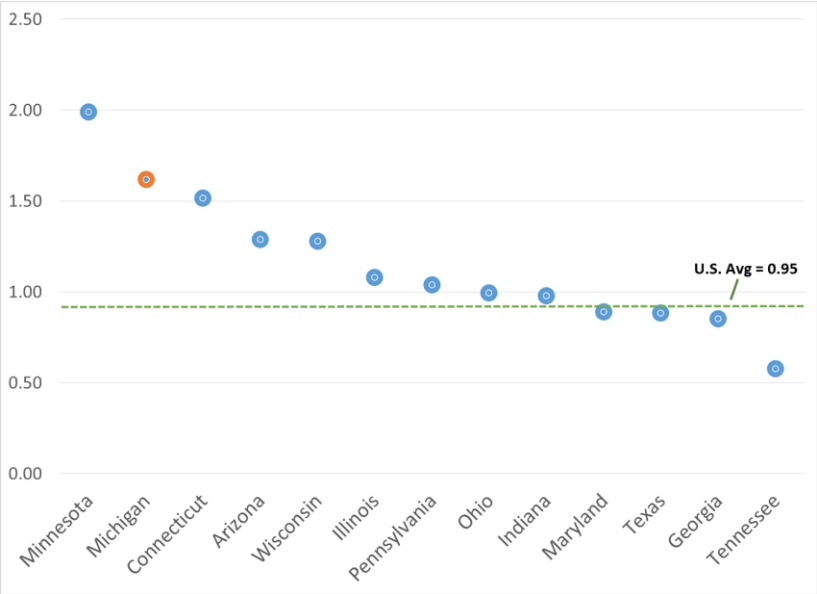
Figure 10. Annual License Income per $10M in Univ. R&D, Avg. 2011–13



Source: Association of University Technology Managers, Licensing Survey, 2013.

Another proxy for innovation is the generation of patents from both universities and industry players. Michigan's patenting efforts have resulted in a mixed outcome for the state. Due mostly to patenting efforts by the state's industry, Michigan was a leader in patents issued in 2014, falling behind only Minnesota in patents issued per $10 million GSP (Figure 11).

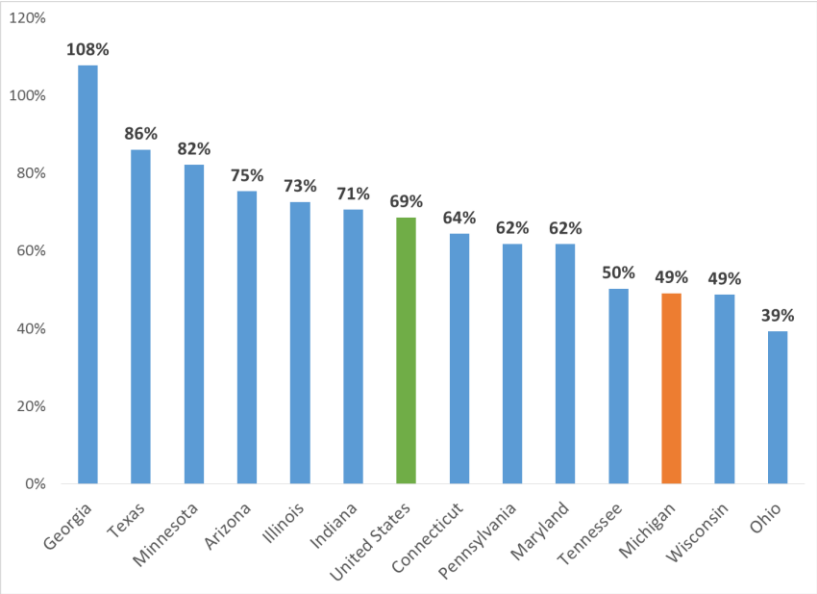
Figure 11. Patents Issued per $100M in GSP, 2014



Source: Thomson Reuters Thomson Innovation patent analysis database.

However, the growth rate in issued patents from 2004 to 2014 places Michigan behind most of its competitor states and the national average with a rank of 11 (Figure 12). Barring the very recent increase in patenting efforts, the university innovation ecosystem in Michigan has generally not kept pace with the nation and lags its competitor states. These barriers could lead to a gradual slowing of innovation in the larger Michigan economy and will need to be overcome if Michigan is to capitalize on its homegrown innovations moving forward.

Figure 12. Change in Patents Issued, 2004–14



Source: Thomson Reuters Thomson Innovation patent analysis database.

Innovation/Risk Capital

Moving an innovative idea from just a thought to a marketable product requires financial backing and support if it is to make it over the "valley of death" and translate to economic returns for the company and the economy as a whole. Venture capital and other risk capital is vitally necessary to meet this need and fuel the innovative ecosystem in an economy.

Michigan has seen significant growth in its venture capital activity over a roughly 10-year period, with investments increasing by 58 percent when comparing the 2004–2006 period with the 2012–2014 period, placing the state third among the benchmarks (Table 5). Venture capital deals grew by 139 percent over the same time frame, well exceeding the national rate and placing Michigan in second place. However, total venture-capital funding levels lagged the nation and benchmarks.

Table 5. Innovation and Risk Capital in Michigan

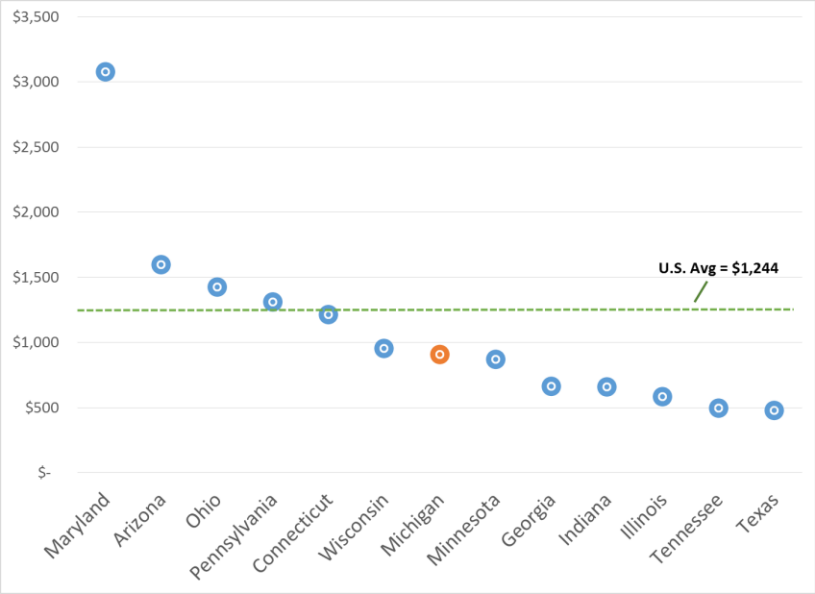
Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
Venture Capital Investments	VC Investments per $10M in GSP, 2012–14	$20,787	$77,088	9th
	Change in VC Investment, 2004–06 to 2012–14	58%	27%	3rd
	VC Deals per $10M in GSP, 2012–14	0.06	0.10	5th
	Change in VC Deals, 2004–06 to 2012–14	139%	27%	2nd
	Share of VC Investments in Seed + Early Stages, 2012–14	25%	29%	8th
	Share of VC Deals in Seed + Early Stages, 2012–14	48%	43%	2nd
SBIR/STTR Awards	SBIR, STTR Awards per $10M GSP, 2014	$910	$1,244	7th
	Change in SBIR/STTR Funding, 2004–14	−6%	−4%	10th

Sources: Thomson Reuters Thomson ONE venture capital database and U.S. Small Business Administration, SBIR.gov SBIR database.

A quarter of all venture-capital investments over the 2012-to-2014 period went to seed and early-stage companies, a critically important area of investment, slightly lower than the national average. The share of venture capital deals going to seed and early-stage companies equaled 48 percent over the same period, surpassing the national rate and ranking Michigan second among the benchmarks. These metrics indicate that capital support for innovative companies, while relatively small, is growing in the state. This growth should be capitalized upon if venture capital investments are to reach national and benchmark levels.

The pattern of strong growth in venture capital is not shared in the growth of federal risk capital. The level of SBIR funding in the state per $10 million GSP was $910 in 2014, lower than the national level and placing Michigan in seventh compared with benchmark states (Figure 13).

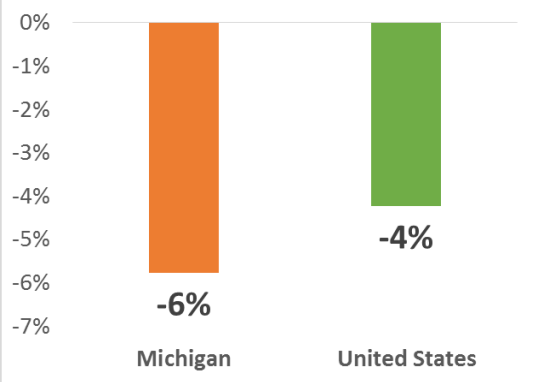
Figure 13. SBIR/STTR per $10M in GSP, 2014



Source: U.S. Small Business Administration, SBIR.gov SBIR database.

Growth in SBIR funding from 2004 to 2014 fell by 6 percent in Michigan, placing the state 10th among its benchmarks (Figure 14). However, it should be noted that the national growth rate fell by 4 percent over the same time frame, indicating an overall decrease in funding for the program.

Figure 14. Change in SBIR/STTR Funding, 2004–14



Source: U.S. Small Business Administration, SBIR.gov SBIR database.

Talent/Human Capital

Research, development, and risk capital are all important factors in economic growth; but, if an economy is not attracting and retaining the right kinds of workers, those efforts will not achieve their maximum potential and economic growth may slow as a result. High- and middle-skilled jobs typically are well-paying jobs that can stimulate the economy both through the income and productivity they bring to a market. High-skilled jobs are those that typically require a bachelor's degree or higher, and middle-skilled jobs generally require some level of postsecondary education, whether that be an associate's degree or a high school diploma with a significant amount of work experience.

In 2014, Michigan's workforce was composed of 21 percent high-skilled jobs, just shy of the national rate of 22 percent (Table 6), and 32 percent middle-skilled jobs, surpassing the national rate of 29 percent and ranking Michigan fourth among the benchmarks.

Table 6. Current Occupational Employment Base in Michigan

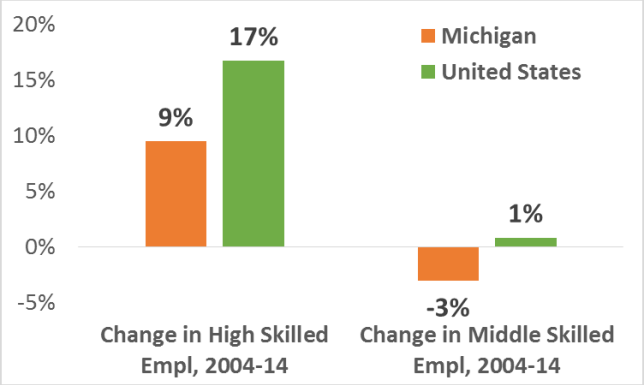
Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
Skilled Talent	Percent Employed in High-Skilled Jobs, 2014	21%	22%	7th
	Percent Change, 2004–14	9%	17%	13th
	Percent Employed in Middle-Skilled Jobs, 2014	32%	29%	4th
	Percent Change, 2004–14	−3%	1%	9th
	Science & Engineering Workers as a Share of Total, 2012	5.1%	4.6%	2nd
	Percentage Point Change, 2003–12	0.8 % pt.	0.7 % pt.	2nd

Note: High-skilled jobs are those that generally require a bachelor's degree or higher upon entry; middle-skilled jobs require some postsecondary education (some college, postsecondary certification, or associate's degree) or a high-school diploma plus significant work experience and/or on-the-job training.

Sources: U.S. Bureau of Labor Statistics, Occupational Employment Statistics survey. National Science Foundation, Science & Engineering Indicators 2014 (for S&E Occupational Employment).

However, growth in these areas has not kept up with the benchmark states. Over the 2004-to-2014 period, Michigan ranked last in high-skilled job growth, and ninth in middle-skilled job growth (Table 6). With regard to percent change in high- and middle-skilled employment, Michigan lags behind the national levels (Figure 15).

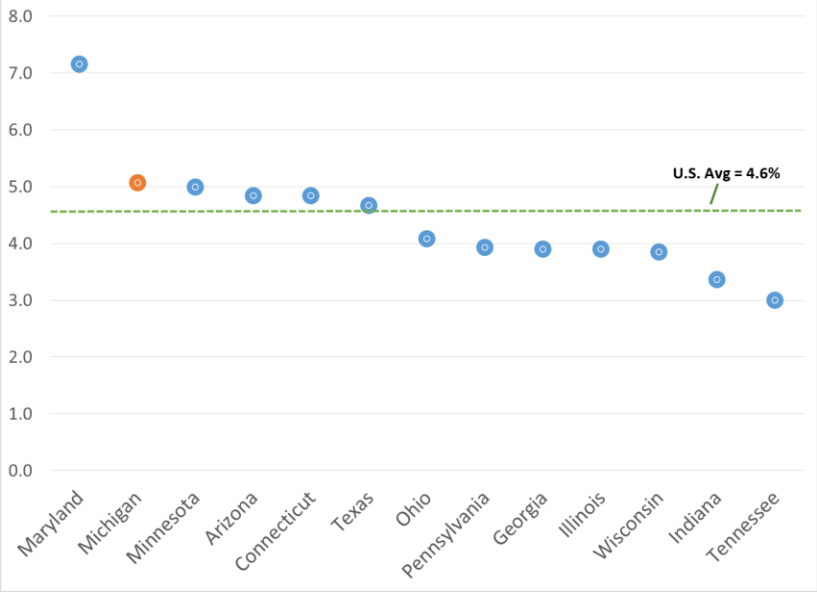
Figure 15. Change in Skilled Employment, 2004–2014



Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics survey, 2004 and 2014.

Science and engineering jobs are seen as highly skilled occupations and an important indicator of an economy's workforce strength. Michigan stands as a leader in this area, with its 2012 workforce composed of 5.1 percent science and engineering workers, ranking Michigan second among the benchmarks and surpassing the national rate of 4.6 percent (Figure 16). Michigan is also leading in the growth of science and engineering jobs as a share of the total workforce, ranking second among the benchmark states over the 2003-to-2012 period.

Figure 16. Share of Workers in Science and Engineering Occupations, 2012



Source: National Science Foundation, Science and Engineering Indicators 2014.

However, one indicator of weakness in Michigan's workforce pipeline is the state's slowing growth in its younger working-age population. From 2004 to 2013, Michigan's 20- to 24-year-old population grew by 5 percent, below the national rate of 9 percent and ranking the state ninth among the benchmarks (Table 7). Growth in Michigan's 25- to 34-year-old population actually shrank by 6 percent over the same period, ranking the state last among the benchmarks.

Table 7. Pipeline of Future Workers in Michigan

Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
K-12 Student Achievement	NAEP Tests, 8th Grade Math, Avg. Score, 2013	280	285	10th
	NAEP Tests, 8th Grade Science, Avg. Score, 2011	157	152	4th
Postsecondary STEM-Related Degrees	STEM Degrees as Share of Total Bachelor's & Above, 2013	19%	17%	2nd
	Percentage Point Change, 2004-13	0.4 % pt.	0.4 % pt.	8th
Population Trends for Younger Working Ages	Population Change Ages 20–24, 2004–13	5%	9%	9th
	Population Change Ages 25–34, 2004–13	–6%	9%	13th

Note: Science, Technology, Engineering and Mathematics (STEM).

Sources: National Center for Education Statistics (NCES), National Assessment of Educational Progress (NAEP). NCES, Integrated Postsecondary Education Data System database. U.S. Census Bureau Population Estimates.

It is obvious that the state's workforce needs to overcome a number of hurdles before it can develop into a greater engine for economic growth. Michigan is definitely utilizing its science and engineering workforce well compared with the benchmark states. Nonetheless, with Michigan losing ground in its high- and middle-skilled workforce, as well as the declining growth in its younger workforce, significant workforce development and retention issues need to be addressed if the state wants to strengthen its position among its regional competitors.

Business Dynamics

All of the metrics reviewed so far have important implications for Michigan's economy. The effects of these measures come to bear on the state's business environment, play out in decisions made by industry members, and have an impact on the overall output of Michigan's economy.

Compared with the benchmark states, Michigan's business environment tends toward the center of the pack. Of all firms formed in the state in 2012, 6.7 percent were new firms, which ranked Michigan seventh among its competitors and below the national rate of 8.1 percent (Table 8, Figure 17). The

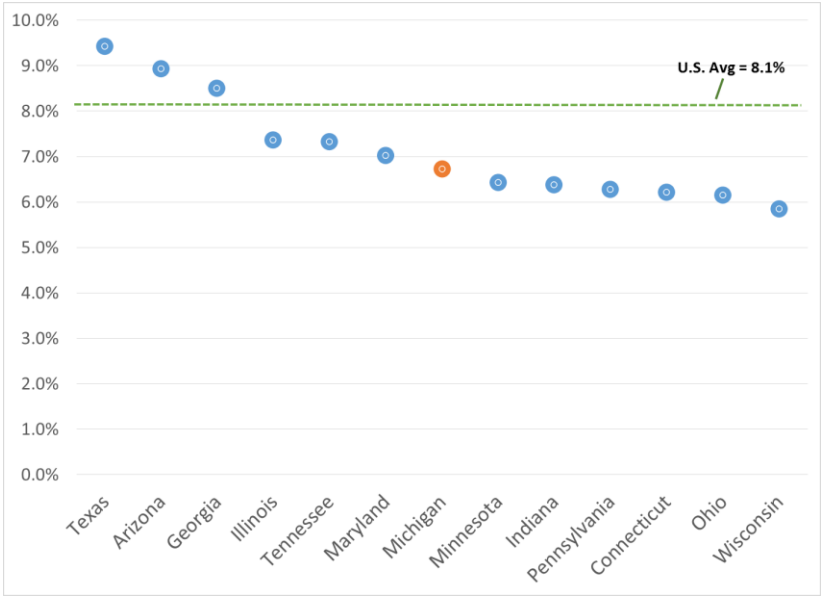
presence of high-growth companies in a state is also an indicator of the health of the business environment, with high-growth companies bringing an increase in jobs and economic returns to an economy. Out of the 5,000 high-growth companies listed by Inc.com in 2014, Michigan was home to 130 of them, sixth among the benchmarks. Over the years, the presence of high-growth companies in the state has declined, with Inc.com listing 16 fewer high-growth companies in Michigan over the 2007-to-2014 period, ranking the state eighth among the benchmarks.

Table 8. Business Dynamics in Michigan

Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
New Firm Startup Rate	Rate of New Firm Formation as a Percent of All Firms, 2012	6.7%	8.1%	7th
	Percentage Pt. Change, 2004–12	−1.8%	−2.2%	6th
Employment in Younger Firms	Share of Employment in Firms Ages 0–5 years old, 2012	11%	11%	4th
	Percentage Pt. Change, 2004–12	−3.3 % pt.	−3.4 % pt.	7th
Presence of High-Growth Companies	Number of Companies on the Inc. 5000 List of Fastest-Growing U.S. Companies, 2014	130	n/a	6th
	Change in Companies in Inc. 5000, 2007–14	−16	n/a	8th

Sources: U.S. Census Bureau Business Dynamics Statistics (BDS), 2004–2012. The BDS data are compiled from the Longitudinal Business Database (LBD), a longitudinal database of business establishments and firms covering the years between 1976 and 2012. Inc. 5000 website (www.inc.com/inc5000). Data for selected benchmark states for 2007 (earliest available) and 2014 (most recent available).

Figure 17. New Firm Startup Rate, 2012



Sources: U.S. Census Bureau Business Dynamics Statistics (BDS), 2004–2012.

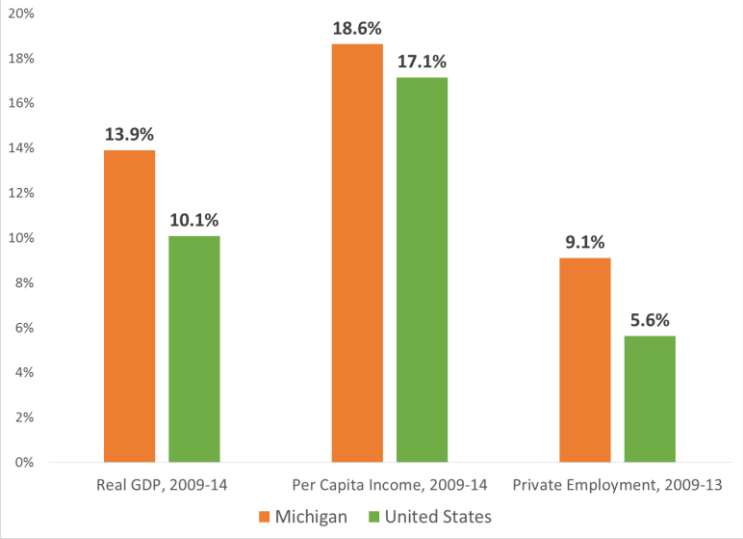
The overall economy in Michigan, while still ranking low among its competitors, has made a strong comeback from the recession. Real gross domestic product (GDP) in Michigan over the 2009-to-2014 period increased by 13.9 percent, higher than the national rate and placing the state second among the benchmarks (Table 9, Figure 18). Growth in per capita income and private sector jobs surpassed national levels and placed Michigan in third and second places, respectively, among its benchmarks. The state's unemployment rate, however, was highest among the benchmarks at 7.3 percent in 2014, higher than the national rate of 6.2 percent.

Table 9. Economic Vitality in Michigan

Measure	Definition	Michigan	United States	MI Ranking vs. 12 Benchmark States
Economic Output	GDP Per Capita, 2014	$42,110	$49,469	12th
	Change in Real GDP, 2009–14	13.9%	10.1%	2nd
Per Capita Income	2014 Level	$40,556	$46,129	10th
	Change, 2009–14	18.6%	17.1%	3rd
Unemployment Rate, 2014		7.3%	6.2%	13th
Private Sector Job Growth, 2009–13		9.1%	5.6%	2nd

Sources: U.S. Bureau of Economic Analysis (BEA), GDP and Per Capita Income. U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Local Area Unemployment Statistics and Current Population Survey.

Figure 18. Change in Key Macroeconomic Indicators Since 2009, Michigan vs. United States



Sources: U.S. Bureau of Economic Analysis (BEA), GDP and Per Capita Income. U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

These metrics point to an economy with a robust existing base of business that has recovered well from the recession. However, the creation of new firms in the state has not kept pace with the nation and lags the leading benchmark states, casting uncertainty about the health of Michigan's business environment going forward. While these measures have no doubt been affected by the recent recession, Michigan's middle-of-the-pack standing among the benchmark states indicates that more work could be done to entice the creation of new firms and retention of high-growth firms, as well as to reduce the unemployment rate in the private sector.

Summary

The metrics and trends reviewed in this chapter show that, while Michigan has significant strengths in key areas, certain barriers to the state's economic growth and potential exist as well (Table 10).

- Michigan has a strong position in both academic and industrial R&D and has seen significant growth in its university-based R&D.
- The state's industry players are becoming a larger source of innovation through their high levels of patenting.
- Growth in risk capital investments in Michigan shows an improvement in the entrepreneurial climate that could help to foster new company creation in the state.
- Michigan has a sizable science and engineering–related workforce that is growing on par with the nation.

However, the long-term strength of Michigan's economy is brought into question by the following issues:

- Michigan's underperformance in university technology transfer, slowing of patenting efforts, decline in industrial R&D, and apparent lack of connection between academic and industrial R&D suggest that the strength of the state's economy could start to wane in the coming years, especially if these trends are not reversed.
- The growth in risk capital has the potential to increase the formation of new companies in the state; however, the question arises as to whether those companies will remain and grow in Michigan, given the state's decline in its younger workforce, below-average growth in high-skilled occupations, and declining growth in middle-skilled occupations.
- Business dynamic issues brought to light through that analysis is a cause for concern. The attraction and retention of fast-growing companies should also be a priority for Michigan.

Table 10. Michigan's Position Across the Innovation/Entrepreneurial Ecosystem

Key Aspect	MI Position/ Performance	Strengths	Weaknesses
Research & Development		Strong position in both University & Industry R&D; Growth of Univ. R&D	Decline in Industrial R&D and slower growth in Industry-Funded University R&D
Commercialization & Deployment		Patents awarded	University technology transfer
Innovation/Risk Capital		Sizable growth in VC deals and funding; share of deals in early/seed stages	Overall level of risk capital, both VC and SBIR, below U.S. and most benchmarks
Talent/Human Capital		Share and growth of workers in key S&E occupations; STEM-related degree grads	Lagging in growth of high- and middle-skilled jobs; losing younger working-age population
Business Dynamics		Mirrors the nation in terms of share of employment in new firms	Rate of new firm formation below national average and number of "gazelles" declining
Economic Vitality		Significant growth in vitality measures	Still below the U.S. average and behind most benchmark states

Overall, the economic climate in Michigan has improved significantly since the recession and shows signs of increasing innovation and support for entrepreneurial ventures. If certain barriers to human capital development, start-up formation, R&D, and other areas could be overcome, Michigan could capitalize on its growing economy and become a leader among its competitor states.

Chapter 4: Situational Analysis

As previously noted, entrepreneurship is a driving force of innovation and economic growth, with small businesses continuing to be the engines for net job growth in the United States. Entrepreneurial activity is critically important to regional economic development because it drives industrial innovation and new business formation. Almost by definition, the founders of start-up companies are innovators—focused on capitalizing on commercial opportunities arising from introducing a new product; enhancing a service; or making a delivery system or production process more efficient, more user-friendly, or less expensive. The founders of start-up companies typically come from established, larger companies, motivated by the identification of an unexploited commercial opportunity and willingness to take the risk that the larger company is unwilling to take. It is, therefore, not surprising that entrepreneurial activity and innovation are strongly correlated.

Most people do not realize that the discovery of new knowledge resulting in the development of new products or processes for resource-intensive industries can be a very expensive process running, in some cases, into millions of dollars. Major costs incurred include the cost of assessing the market to determine the competition, the likely market, and the price points for competitive advantage; developing a prototype; preparing a marketing and sales plan; and scaling up for manufacturing. Finally, actual product distribution, sales, and marketing must be undertaken. These activities require the availability of sufficient capital to finance business growth and economic development.

Yet, few sources of funding bridge the gap between the points at which (1) a discovery has been identified and demonstrated and (2) a business case has been validated and venture or other debt capital can be obtained. Those regions that are able to gain access to financing for their growing/emerging companies have a greater likelihood of reaping the economic benefits of growth. Yet, with a few notable exceptions, the entrepreneurship and risk-acceptance climate necessary to generate high-growth enterprises has not developed fully and sustainably in most regions through market forces alone.

As a result, fostering the growth of entrepreneurial companies must be a critical component of any region's efforts to accelerate the growth of its economy. However, developing successful initiatives and programs that catalyze innovation and entrepreneurialism is a challenge for many regions. It is often stated that entrepreneurship is a "contact sport," and the barriers and obstacles to being able to scale up a firm is significant, particularly technology firms. The two areas that entrepreneurs indicate are their greatest obstacles are access to talent and risk capital.

Of these, the most significant obstacle to creating and growing entrepreneurial companies is the lack of experienced management talent. For many regions, there simply is a lack of experienced, serial entrepreneurs who know how to turn an idea or a product into a successful venture. Serial entrepreneurs are needed not only to lead new ventures but also to serve as mentors to help fledgling entrepreneurs develop their skills and increase their chances of success. They have contacts in the investor community, can recognize quality deals, and help to generate deal flow, all of which helping firms access capital markets.

The second challenge facing entrepreneurs is access to financial capital. Entrepreneurs require access to capital at each stage of their development, from early stage, proof-of-concept, and prototype development to Series A and B venture financing. Regions that have limited risk capital to invest end up leaving their entrepreneurial companies "on the runway," unable to take off and reach their growth potential. Having locally managed, indigenous sources of financial capital is essential for building the "farm club" of firms, which, as they gain experience and need additional funds to expand, become candidates for "major league" funding from larger, more diversified venture funds both in the region and outside the region. In other words, the presence of regional sources of financial capital is needed to attract outside regional and national funds to invest.

Since the 21st CJF Initiative was created in 2005, investments in innovation and entrepreneurship programs and initiatives have been focused on

- Catalyzing the growth of technology start-up companies
- Increasing the availability of risk capital
- Fostering the commercialization of new products, processes, and services.

The previous chapter attempted, through a quantitative approach, to analyze how these programs and initiatives collectively have shifted or altered Michigan's innovation/entrepreneurial ecosystem over the past decade. While the analysis can point to advancements in key metrics across the ecosystem and compare how Michigan is performing in relation with its peers, it cannot qualitatively examine specific strengths of the initiatives that should be further leveraged or barriers to development that must still be overcome. To help determine how to further encourage innovation and entrepreneurship in Michigan, the project assessed the challenges facing Michigan entrepreneurs by interviewing key entrepreneurial service providers, risk capital investors, and other key stakeholders to better understand the climate for innovation and entrepreneurship. By analyzing the areas of strength as well as the gaps within the three thematic areas of investment—talent, capital, and product—this chapter will attempt to ascertain how the state's overall innovation/entrepreneurial ecosystem is functioning.

Growth of Technology Start-Ups

There was broad consensus of opinion across all of the interviews conducted with key thought leaders that the level of entrepreneurial activity in Michigan has grown significantly since the turn of the century. Prior to the early 2000s when investments were made in programs that predated and morphed into the 21st CJF, there was minimal start-up activity in Michigan. The 21st CJF helped to fund both statewide efforts as well as regional activities that spurred entrepreneurial services and assistance. Today, a robust entrepreneurial-service delivery system is in place that provides regional services through regional models targeted at meeting more localized needs, as well as statewide through Michigan's SBDC Tech Team program. These services work to fill the void of managerial talent to help companies launch and grow in the state of Michigan.

While there is broad consensus that the innovation and entrepreneurship climate has greatly improved, there is also a widely held understanding that much more is left to be done. As the benchmarking quantitative data indicated, even with the growth of support services, Michigan's level of entrepreneurial business dynamics has not been significantly altered on the macro-level scale. When compared with the benchmarks and the nation, Michigan ranks in the middle in terms of the number of

high-growth companies and is below the national average in terms of the number of new firm formations.

The number one barrier that was identified as hindering the growth of technology start-ups was the lack of C-level talent (executive talent) to drive scalable growth within the start-up companies that do exist in Michigan. This lack of C-level talent is compounded by a perceived lack of mentors to drive commercialization. Those interviewed felt that there was a significant need for additional advice/guidance via serial entrepreneurs, corporate mentors, entrepreneurs-in-residence, angel investors, etc.

The second significant barrier identified related to the entrepreneurial assistance system that has been put in place across the state to varying degrees of success. While the issues varied depending on the interviewee's point of view, what was consistent in thought was that the "system" itself was not leveraging the investments to the fullest extent possible. For example, within some urban settings, there was a view that service providers are duplicating services, causing tension and "alphabet soup" within the user community. There was the fear that service providers were "competing" for clients and deal flow, often offering redundant services within the same regional geography. At the opposite end of the spectrum, within less-populated locations, interviewees voiced concerns that investments were being made at a subcritical level that had minimal impact, thereby utilizing resources that resulted in minimal outcomes rather than leveraging investments that could be scaled up to a statewide level of service. For example, resources have been invested in bricks-and-mortar incubators that some feel are not then adequately staffed with value-added services, thereby minimizing entrepreneurial service delivery to a real-estate function instead of focusing on scaling up companies. The question then becomes this: How can a statewide service delivery system be developed that ensures value-added services are delivered adequately across Michigan that in turn does not result in redundancies?

Availability of Risk Capital

There was a second broad consensus of opinion across all of the interviews conducted with key thought leaders that the level of risk capital available in Michigan has grown significantly over the past decade. Prior to 2004, the availability of risk capital was extremely limited, with indigenous funding at the angel and pre-seed level being nonexistent. Michigan was considered a "flyover" state by national venture capitalists, and most of the funding that did exist in the state often left to invest elsewhere. Today, there has been significant growth in the level of indigenous funds available (with significant emphasis in pre-seed funding and a growing level of interest in angel funding) and increasing presence of national funds with a regular presence in the state.

In the previous chapter, the benchmarking quantitative analysis utilized the Thomson ONE venture capital database, which provides a comprehensive tracking of formal venture-capital deals from the seed/early stage through acquisition stages. The database can be used to track venture capital investments in all Michigan companies, regardless of whether the funding originated from a Michigan-based investor, and then compare that data with other states and the nation as a whole. The database, however, does have a greater level of difficulty tracking very early-stage deals and at times is not reflective of all investments that have been made.

In an effort to be as inclusive as possible of all risk capital investments made throughout the state, the analysis turns to the Michigan Venture Capital Association (MVCA) to more closely examine and track the investments of risk capital firms doing business in Michigan. MVCA's data differ from the national venture-capital database in its ability to identify more of the earlier pre-seed deals and provide more detailed information on the investments of Michigan-based funds. However, it does not provide full comprehensive analysis of all venture capital funding to Michigan companies. Therefore, it is important to examine both data sets.

Examination of the MVCA data confirms the interviewees' belief that both the number of risk capital firms with a presence in Michigan and their overall level of activity have increased. As Table 11 illustrates, both the number of venture capital firms with a presence in Michigan as well as the level of risk capital investments have grown significantly over the decade. Between 2006 and 2014

- The number of venture capital firms located in Michigan more than doubled;
- The amount of venture capital under management among firms operating in Michigan nearly quintupled;
- The amount of venture capital invested in Michigan start-ups by Michigan venture-capital firms nearly doubled; and,
- The number of deals (number of firms receiving investments) nearly tripled.

Table 11. Michigan Venture-Capital Investment Activity

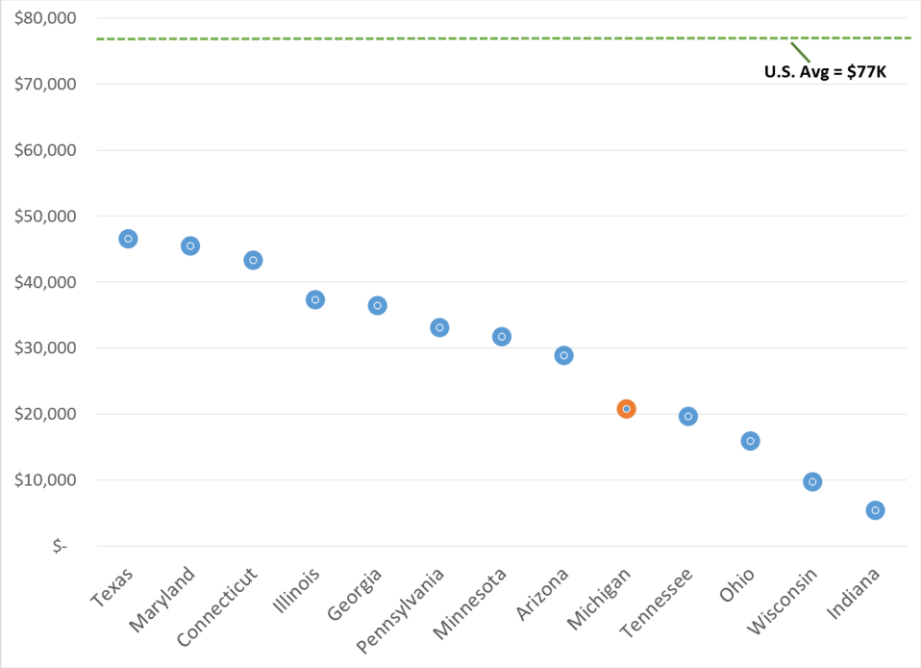
Measure	Definition	2006	2014	Growth
Michigan Venture-Capital Firms	VC Firms Located in MI	15	37	+22; 146%
	VC Investment Professionals in MI	40	115	+75; 188%
	VC Under Management among Firms Operating in MI	$0.9B	$4.8B	+$3.9B; 467%
Venture Capital Investments	VC Investments in MI Start-ups from MI VC Firms	$103M	$204M	+$101M; 98%
	# MI Startups Receiving VC Investments from MI VC Firms	13	51	+38; 292%
	$ Share of VC Investments at Seed + Early Stage	n/a	66%	n/a

Source: MVCA.

Interviewees suggested that Michigan's ability to attract and grow such a significant level of investment activity was in part due to the fact that the 21st CJF helped to legitimize the fund-raising efforts of new funds through its own investments, thereby helping to catalyze the creation and growth of indigenous funding activity. This in turn helped Michigan to develop a reputation of having successfully stimulated a growing risk-capital market with investable deal flow, which in turn attracted national venture-capital firms to look at and invest in Michigan deals. The bottom line is that, as of 2014, 21st CJF investments in risk-capital financial programs totaled $204.7 million over the time period, which had leveraged an additional $621.3 million in follow-on private risk-capital investments, a leverage ratio of 3 to 1.

While there is broad consensus that the risk capital climate has greatly improved, there is also a widely held belief that the investment culture is at great risk of disappearing without further additional investments by the state. As the benchmarking quantitative data indicated, even with the sizable growth in the level of risk capital investments, Michigan still falls below the national average of venture capital investments when the data are normalized (Figure 19) and ranks ninth amongst the benchmarks. It is a widely held belief that the national venture-capital funds are monitoring Michigan's risk capital landscape, and, if investors think the state is not committed to supporting entrepreneurial development, then they will disengage and invest their funds' resources in regions that are committed to building an entrepreneurial culture. As a result, the risk capital climate is very fragile and can easily be disrupted.

Figure 19. Venture Capital Investments per $10M in GSP, 2012–14



Source: Thomson Reuters Thomson ONE venture capital database.

This then raised the concern that there is the danger of leaving companies "on the runway" if additional rounds of funds are not raised. Most existing funds are in a harvest period or investing in later stages. Few funds have the capital left to invest in early-stage companies. As a result, the significant number of companies that have received early-stage investments may not have the capacity to raise their next tranche of funds in Michigan if the investment dollars dry up. This will either leave the companies unable to grow and scale up or force them to seek funding from elsewhere, which may lead to the relocation of these promising young firms.

In addition to the concerns expressed above, two additional barriers were identified as hindering the growth of technology start-ups: (1) lack of organized angel networks and (2) lack of non-asset-based working-capital loan programs. These two concerns represent issues on the opposite ends of the risk

capital spectrum. The lack of organized angel networks was attributed to the relatively conservative nature of Michigan investors and the lack of state programs and/or initiatives to catalyze such investments. The lack of non-asset-based working-capital loans is particularly harmful since many of the start-up companies within the portfolio are within industry sectors that are not always attractive to traditional risk-capital markets, but in which Michigan excels (i.e., advanced manufacturing). Both concerns point to the need to ensure that companies are able to access financial capital throughout their stages of development.

Commercialization and Deployment of New Products, Processes, and Services

Commercialization can be defined as the capacity to streamline and accelerate the process by which market-driven research is translated into products or processes that create economic value. In today's economy, product life cycles have shortened while technical sophistication has increased. Developing a pipeline of innovative new technologies is critical to ensuring industry development does not stagnate, particularly in industries where new products and technologies are heavily dependent upon the commercialization of industrially relevant research.

In discussions with key stakeholders, there was general agreement that Michigan's academic research institutions had recognized the importance of commercializing and deploying the technology it developed and, as a result, had increased their focus on business engagement over the last decade. This focus included incorporating more flexibility with IP terms and undertaking master agreements. In addition, the universities had become more engaged with student entrepreneurship efforts as well as integrating themselves into regional economic-development efforts, including regional incubators, entrepreneurial support services, and risk capital investors.

Interviewees were concerned that a significant amount of initial 21st CJF investments were awarded directly to companies for commercialization efforts and, for the most part, results had been limited. There was overall agreement that, in the current plan to invest commercialization funds through intermediaries (universities and, in some instances, service providers), the funding would have a greater chance to have meaningful impact. There was still significant concern that the evolution of programmatic commercialization efforts has been substantial (MUCI, MIIE, MCRN, T3N, M-TRAC, UCF) and, within the rapid pace of the evolution, good programmatic aspects have been either underfunded or discarded with elements that were viewed as not working.

In addition, as the previous chapter noted, Michigan lags the nation and other benchmarks in key university technology-transfer outcomes. While some felt that these statistics were lagging reality as significant emphasis and effort have been put in place to improve these outcomes in recent years, it is still unclear whether or not important strides are being made. Furthermore, while Michigan's standing with regard to R&D is still strong, there are indications that this strength may be waning, and the state could lose ground to its competitors because of a lack of connection between industry and academia. Key stakeholders expressed concern that university research was not well known by companies and often did not focus on their unmet needs, with a resultant commercialization pathway able to be identified. In addition, communications, access, and licensing issues continued to provide challenges for

industry. Stakeholders were concerned that these barriers could lead to a gradual slowing of innovation in the larger Michigan economy, which will need to be overcome if Michigan is to capitalize on its homegrown innovations moving forward.

Programmatic Oversight and Operational Performance and Management

While the discussion so far in this section has focused on how the investment portfolio of programs and initiative has been able to effectively meet the intended purpose of the 21st CJF (talent, capital, and products), it is also important to examine the situation in which MEDC has provided programmatic oversight and operational management of the portfolio of entrepreneurial companies and start-ups that are the beneficiaries of state support, to the intermediary organizations that provide direct assistance to these companies, and ultimately, as the state's lead agency for economic development, the development and support of a robust innovation/entrepreneurial ecosystem.

In effect performing as the "management intermediary" for the MSF's 21st CJF, the MEDC has proven itself to be an organization that allows for evolution and change as statewide economic conditions change and as best practices and improvements are identified. The MEDC has invested in measurement systems to support the management and evaluation of these programs, yet many of the key stakeholders interviewed felt that the systems could be further evolved to more effectively understand its investment portfolio and manage program diversification to meet continuing needs.

The very nature of entrepreneurial support and assistance efforts cause a continual need to understand progress and performance and to answer the basic questions—is it working and does the existence, growth, and economic value of these firms warrant continued investment?

Answering these questions at the state level becomes more challenging due to the systemic decision to enable statewide support through a combination of the direct activities of MEDC (e.g., specific funding programs) and assistance via statewide and regionally focused intermediary organizations. The use of these different levels and organizations for service delivery (some of which have additional stakeholders and funders beyond MSF/MEDC) provides strong benefits by providing service delivery as near to the entrepreneur as possible. This structure, however, can also lead to certain aspects of service provision and management taking on an extra level of complexity. For example, the collection and reporting of performance metrics can become redundant across the system as different stakeholders ask for the same basic information but in different forms. Furthermore, the additional required frequency of reporting is resulting in survey overload among the entrepreneurs and start-up companies being assisted—leading to overwhelmed respondents. Ultimately, this combination of disjointed systems and entrepreneurs skeptical of these efforts lead to inferior data collection and/or potential inconsistency in the definitions of metrics, leading to over-reporting and under-reporting.

A further challenge, one shared by similar entrepreneurial support efforts around the country, is that metrics are often simplistic in nature and do not allow for proximate measures of success, particularly in the more upstream activities of commercialization.

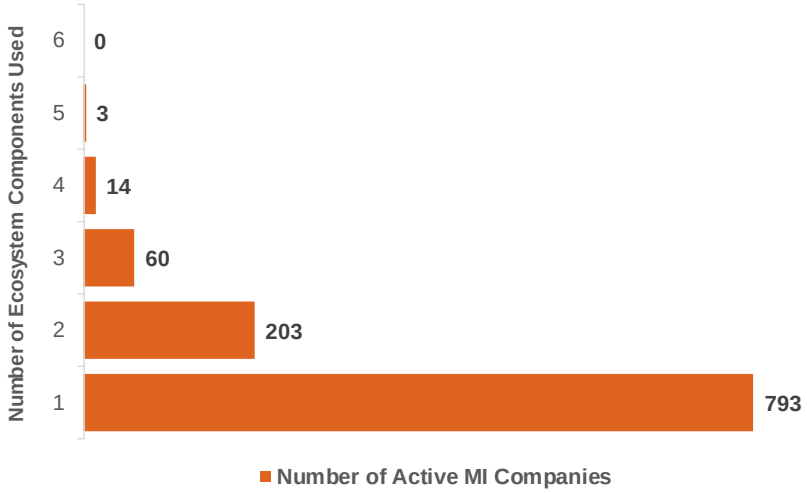
For the ultimate success, visible in a robust entrepreneurial culture and highly visible and celebrated economic vitality, the supporting ecosystem needs to be integrated, self-reinforcing, and accountable for true performance. Entrepreneurs need to easily understand how they gain entry and access to the

ecosystem of support, how they are moved through the system of support, and when to exit the support network. To illustrate the current situation, an assessment was performed on the entire portfolio of active companies to understand their interconnections with the current entrepreneurial ecosystem. This assessment found that, of the 1,073 active companies (2014) that have engaged the MEDC Entrepreneurial Services ecosystem[13]:

- 862 (80 percent) have received some level of entrepreneurial support or incubation services;
- 329 (31 percent) have received funding from one or more of the early-stage (non-pre-seed) funding programs;
- 106 (10 percent) received funding from the one or more of the pre-seed funding programs;
- 92 (9 percent) received direct funding from the 21st CJF (i.e., not via third party fund or program; primarily investments from early in program—including the Michigan Life Sciences Corridor);
- 21 (2 percent) received funding from the Technology Transfer Talent Network program;
- 111 (10 percent) received a venture capital investment of some type, with 40 (4 percent) receiving an investment from a Michigan-backed VC fund.

The assessment showed that 74 percent of these active companies have used only one ecosystem component—demonstrating very limited flow from service to service and potential issues with integrated service delivery (Figure 20). Additional analysis also showed that there was some distinct variability in the use of different components of the ecosystem depending on the industry sector of the entrepreneurial company.

Figure 20. Number of Companies Using Various Ecosystem Components



[13] This analysis was limited by missing or incomplete data from some components and service providers within the Michigan entrepreneurial ecosystem.

Chapter 5: Strategic Recommendations

For most states, promoting entrepreneurship has not been part of the mainstream programmatic efforts of traditional economic-development policy. However, for those states that have had the foresight to focus on technology-based economic development to meet the needs of the 21st century, significant investments have been made in programmatic efforts to foster an environment that supports both innovation and entrepreneurship. Michigan has been one of the states with such foresight.

After over a decade of investment, Michigan is now asking not only what the impact and effectiveness of these programs have been, but also what additional needs still exist to foster the robust development of the innovation development chain. Based on a review of the impact of Michigan's innovation and entrepreneurship efforts, how these efforts have positioned Michigan against the nation and other states, as well as a review of the current strengths and barriers facing innovation and entrepreneurship, this section of the report identifies a series of recommendations to encourage and support innovation and entrepreneurship in Michigan for the coming decade. These recommendations focus on the following:

1. Providing the requisite talent that covers the continuum of needs from early-stage start-ups to scalable enterprises
2. Facilitating access to risk capital at all stages of development
3. Fostering the commercialization and deployment of new products
4. Providing improved programmatic oversight and operational management.

This section offers examples of how other states and regions have implemented these strategies and describes efforts underway in Michigan to address them.

Providing Requisite Talent to Meet Entrepreneurs' Needs

To ensure the greatest chance of success, entrepreneurs must have access to a comprehensive continuum of programs as they progress through the stages necessary to establish a thriving enterprise. The services do not necessarily have to be provided by a single entity, but they need to be readily accessible to the entrepreneur.

Support services that technology entrepreneurs value include:

- Business mentoring by successful serial entrepreneurial managers who have been involved in similar businesses and business models;
- In-depth counseling and advice to prepare the entrepreneur to present investment-grade plans to angel and other informal investors; and
- Assistance with forming a business team of managers to assist with market research, technical evaluations, regulatory issues, etc.

The 21st CJF has invested in a number of entrepreneurial support service organizations that provide assistance throughout the state. However, the situational analysis uncovered a number of opportunities in which additional value-added services could be incorporated into the programmatic offerings as well

as restructuring/leveraging current programs to provide consistent services throughout the state. The first four recommendations address this issue.

Recommendation 1: Develop an Executive Connect Program

One of the characteristics that distinguishes regions/states with high levels of entrepreneurial activity is the networking that occurs among companies and between researchers and the venture community. Networking is an extremely important way in which entrepreneurs can learn from others who have encountered similar obstacles. Indeed, research indicates that the extent of social networks is one of the most important factors in encouraging entrepreneurship in any region. For this reason, creating opportunities for networking has become an important component of state and regional efforts to promote entrepreneurship and the growth of entrepreneurial firms.

Networking can occur in a variety of settings, from breakfasts or luncheons where entrepreneurs make presentations or hear from service providers, to recognition events, to the casual interactions that occur among entrepreneurs who share space in an incubator or a research park.

Mechanisms that facilitate intensive networking within and between industry sectors cultivate a proactive environment. The most successful technology regions facilitate extensive and intensive networking both across the academic/industrial boundary and between companies in allied sectors or in a supply-chain relationship. In a very few leading communities like Silicon Valley, this networking has occurred naturally, with formal organizations like Joint Venture-Silicon Valley coming only later. However, in the vast majority of regions attempting to build technology sectors, formal networking organizations are built from the ground up; otherwise, the desired degree, scale, and intensity of networking will not occur.

What Others Do: San Diego's CONNECT

The CONNECT program at the University of California–San Diego is a network facilitation model that has achieved tremendous success in growing San Diego's technology-based economy. CONNECT was founded in 1985 to foster entrepreneurship in San Diego. CONNECT links entrepreneurs with the resources they need: technology, capital, markets, management, partners, and support services. Its programs serve as a catalyst for the development and exchange of ideas, a forum to explore new business avenues and partnerships, and an opportunity to network with peers. CONNECT holds workshops and courses, hosts events where entrepreneurs can meet angel investors, and makes awards. CONNECT's Springboard program provides free assistance for companies at all stages of development. Companies participate in 3- to 8-week coaching sessions with Entrepreneurs in Residence or Springboard Fellows, after which they present their business model to a group of experts. CONNECT hosts 100 or more events per year. CONNECT has assisted in the formation and development of more than 2,000 companies since its launch in 1985 and has assisted over 1,000 companies in funding their operations. Over 300 companies have graduated from the program and raised more than $700 million in funding. After 20 years, CONNECT is completely self-supported from membership dues, course fees, and corporate underwriting.

While there are a number of regional service providers who have developed various networking events, none have risen to the scale and size to reach into the highest level of mentors and have significant statewide scale. It is recommended that programmatic investment be made in developing cluster-specific statewide networking/mentor programs that are of the scale to attract quality deal flow that will in turn attract the top corporate and serial entrepreneurs to invest their time into developing relationships.

Recommendation 2: Develop Cluster-Specific Entrepreneur-in-Residence Programs

Entrepreneurs-in-Residence is a concept that many entrepreneurial assistance organizations have adopted over the last decade, including many organizations in Michigan. Under a typical arrangement, companies who become part of an organization's portfolio are assigned the services of an Entrepreneur-in-Residence (EIR). The EIR team consists of highly experienced entrepreneurs who have been involved in the successful creation of technology-based start-up companies and early-stage venture deals. Each portfolio company receives a significant level of value-added commercialization expertise from their assigned EIR, who plays an operating role in the company. Many EIRs will eventually transition to full-time employee status with one of his/her portfolio companies. This strategy of recruiting and tapping the expertise of EIRs is one tactic of a number of states for bolstering the executive talent pool within the region.

What Others Do: Pittsburgh Life Sciences Greenhouse (PLSG)

As a dedicated organization focused on growing emerging life-science companies, PLSG combines incubation and early venture financing with a successful effort to advance entrepreneurial talent to lead life science innovations. From 2001 to 2014, PLSG had made approximately $20 million of direct investments to 75 companies, which has leveraged over $900 million of additional capital for the region. One of the keys to PLSG's success—that addressed a significant challenge for the region—is an Executive-in-Residence (EIR) program, which was started to provide emerging life-sciences companies with domain-specific, C-level leadership, providing executive talent to help form companies; subject matter experts to guide companies; executives to run companies; and program managers and directors to help companies grow. In 2005, the PLSG expanded the EIR Program to extend its areas of support and to add specialists for the life sciences community that will work more directly with institutional and private investors and the venture capital industry at large—and renamed it the Executive Program. Since inception, 46 executives have participated in the PLSG EIR program, 4 are currently active in the PLSG Executive Program, 30 former EIRs remain in the region (15 as CEOs and 15 as C-Suite and Executive Team members), and 13 of those 30 represented life sciences executives who relocated to the Pittsburgh region. The importance of the Executive Program is that the 30 companies that now employ former PLSG EIRs makes up a large share of the 75 life sciences companies that PLSG has invested in over its 12+ years. An added feature of the Executive Program is an internship program that mentors students from local universities interested in becoming life science entrepreneurs to work directly with PLSG portfolio companies. The Executive Program also fits well as a means of supporting the 21,000-square-foot incubator facility that PLSG maintains.

Recognizing that the needs of various industry sectors can vary widely, many states are recognizing that engaging EIRs with specific industrial experiences to serve key targeted clusters is paying dividends in advancing the innovation culture of the state. A few of the organizations in Michigan are beginning to engage in this approach; but, to have statewide impact, it is recommended that 21st CJF investments be geared toward developing a wider network of EIRs that could serve specific industry clusters instead of necessarily specific organizations. The pool of talent could be disbursed to where the greatest opportunity exists to scale up companies that have the tightest linkages to Michigan's economy.

Recommendation 3: Provide Additional Funding for the Executive Attraction Program

One of the entrepreneurial talent development programs that Michigan has previously invested in is the Executive Attraction Program managed by MVCA. However, the program is currently out of funding. The Executive Attraction Program was designed to increase the number of venture-backed executives in Michigan and has been expanded to include all C-level and senior sales and marketing positions at venture-backed firms. The program provided assistance with recruiting and first-year salary expenses associated with hiring exceptional talent at qualified MVCA member portfolio companies, with the goal of increasing the number of successful portfolio companies in Michigan.

It is recommended that this program receive additional funding so that it can continue to support this talent initiative. The funding could also be utilized to help support the EIRs referenced in the previous recommendation, linking the two programs together. If the program is reconstituted, it will be important that the legislative burdens of the program be eased to ensure nimbleness, speed, and responsiveness to real-time needs.

Recommendation 4: Streamline Entrepreneurial Service Providers to Ensure Consistent Value-Added Assistance Statewide

As referenced in the situational assessment, it is perceived that there are varying degrees of quality across the large number of service providers that receive dollars to provide entrepreneurial assistance. In addition, in some regions, there is competition and redundancy of services leading to an "alphabet soup" for the user community. The question raised was this: How can a statewide service delivery system be developed that ensures value-added services are delivered adequately across Michigan that in turn does not result in redundancies?

One potential solution would be to create regional service hubs similar to how the Ohio Third Frontier has handled geographic coverage (see text box). Within each region, a single intermediary would be responsible for providing entrepreneurial assistance. The intermediary would then need to work across the region by developing partnerships to ensure that services could be accessed regardless of the geographic location of the company. This model would help ensure consistency in terms of the quality of service, integration of the various programmatic components, as well as a proportional disbursement of resources based on generated deal flow.

What Others Do: Ohio Third Frontier Entrepreneurial Signature Program

The Ohio Third Frontier began investing in entrepreneurial services through its Entrepreneurial Signature Program (ESP) in 2008. Ohio divided the state into six regions and awarded the ESP Hub to one technology intermediary organization. The goal of the ESP is to significantly increase the technology-based entrepreneurial commercialization outcomes throughout a defined geographical region and to focus the effort on strategic technology-based sectors that offer exceptional economic-development prospects for the region. Each ESP represents a comprehensive, coordinated network of high-value services and assistance providers that is visible and easily accessible to technology-based entrepreneurs and small tech-based companies throughout its region. Each ESP provides an approach that tightly integrates sources of deal flow, entrepreneurial support, and capital to effectively grow the technology-based entrepreneurial commercialization outcomes throughout its region. Through 2013, the Ohio Third Frontier had invested $125 million across the six regions in ESP programmatic support. Those funds have leveraged an additional $2.3 billion in follow-on funding and helped to create more than 5,000 jobs.

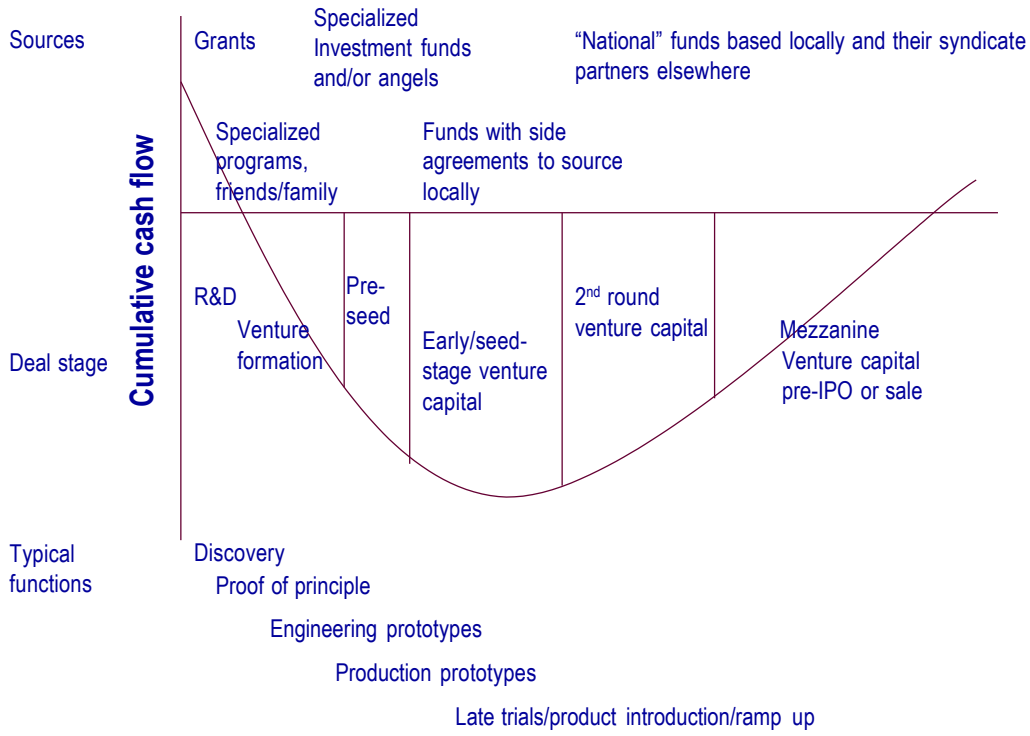
This regional model would be further enhanced, unlike in Ohio, with the strength of the SBDC Tech Team. The SBDC Tech Team provides value-added entrepreneurial assistance to technology companies throughout the state of Michigan. The Tech Team enables entrepreneurs to bridge the gap between technology development and commercialization. It currently consists of nine consultants with proven track records in technology commercialization. In addition to receiving 21st CJF investment, the Tech Team oversees a number of 21st CJF investments, including the BAF and the ETF. It is recommended that investment in the Tech Team be further enhanced through funding of the regional hubs to help ensure that value-added assistance is available throughout the state without necessarily having to make the local investment to provide potentially subpar services with limited deal flow. By leveraging the unique asset of the Tech Team, Michigan will be able to position itself to provide strong coverage statewide.

By creating the regional hubs with close ties to the statewide service provider, the “lead” service provider will be able to administer programs and disburse funds to partnering statewide and local organizations, thereby cutting down on redundancy of generic services and providing value-added acceleration services covering the entire state. This will focus Michigan’s investments on impactful services rather than “alphabet soup.”

Facilitating Access to Risk Capital

States and regions with thriving entrepreneurial sectors share one characteristic: they are home to a venture capital community that is both oriented toward early-stage financing and committed to local investment. Having state-based venture capital funds is critical. It is also critical to have financing available for each stage of development from early-stage, proof-of-concept, and prototype development to product expansion and later-stage venture financing (Figure 21). Leading technology states typically have access to commercialization funding, pre-seed and seed funding, and later-stage venture financing. States and regions wishing to grow entrepreneurial companies have used a variety of mechanisms to encourage investment in venture capital and to address market gaps, particularly at the commercialization and pre-seed stages.

Figure 21. Capital Needs at Stages of Company Development



The 21st CJF has invested in a number of risk capital funds across the various deal stages. However, the situational analysis uncovered a number of opportunities in which risk capital is needed to ensure that the portfolio of companies is not left stranded "on the runway" and that there is adequate risk capital available to fund new ideas that are progressing through the pipeline. The next three recommendations address these opportunities.

Recommendation 5: Create the Third Fund of Funds with Restructured Terms and Strong Ties to the Michigan Pension Fund and Other Institutional Investors

Through a Fund of Funds (FoF) model, investments are made in a portfolio of venture funds with the assistance of a general fund manager, who helps select those venture funds best suited for the state. The FoF approach mobilizes venture capital investors who are willing to consider investing in emerging companies located in the state.

The 21st CJF has already helped create two FoFs in Michigan, both of which are widely credited with helping to alter the national perception of Michigan being a "flyover" state in terms of deal flow. While some have questioned the terms of the original funds, it is important to note that many models exist to catalyze such an investment vehicle. If policy makers are uncomfortable with the existing terms, it is certainly within their purview to structure a different funding model for the third fund. That being said, it would be extremely shortsighted to simply do away with such catalytic and impactful investment activity altogether. It is recommended that Michigan create the third fund of funds with restructured terms (see text box below for different models) and strong ties to the Michigan Pension Fund and other institutional investors to ensure that the momentum that has been built does not wane and the funds that the two previous funds have created do not disappear.

What Others Do: Models for Fund of Funds

Colorado Venture Capital Authority (VCA). The VCA was established in 2004 to make seed- and early-stage capital investments in businesses. The VCA was allocated $50 million in premium tax credits, which it subsequently sold to insurance companies. The VCA selected fund manager High Country Venture, LLC, and established Colorado Funds I and II, each with nearly $25 million. The minimum and maximum investment size generally ranges from $250,000 to $3.375 million. As of February 2015, 31 emerging companies received investments across the two funds of nearly $46 million, leading to the creation of over 1,200 jobs.

Utah Capital Investment. Formerly known as the Utah Fund of Funds, this venture capital initiative is a $300-million state of Utah economic-development program aimed at providing access to alternative or non-traditional capital for Utah entrepreneurs. Utah Capital Investment invests in venture-capital and private-equity funds that commit to establishing a working relationship with Utah's start-up and business community and to making investments in qualifying companies. A number of venture capital funds targeting life sciences have received funding, including 5AM, Frazier Healthcare Ventures, NEA, SV Life Sciences, TriVentures, and UpStart Ventures. To date, $785 million have been invested in 73 Utah companies by Utah capital portfolio funds since fund inception, of which 60 remain in operation, and 4,069 new Utah jobs have been added.

New PA Venture Capital Investment Program. Authorized $60 million as loans to venture capital companies seeking to invest in Pennsylvania firms. The New PA Venture Capital Guarantee Program authorized up to $250 million of guarantees on the first losses of equity investments made in Pennsylvania companies by qualified venture-capital firms to be matched 1:1 with additional investments.

The Maryland Venture Fund—InvestMaryland. Through an auction of premium tax credits to insurance companies, the State of Maryland raised $84 million to invest in qualified private-venture funds to further catalyze the state's local venture-capital community. Those funded have committed to invest in emerging technology companies in Maryland in the areas of life sciences, software, communications, and cybersecurity, with the goal of investing in 150 or more companies and generating 5,000 jobs created or retained.

Recommendation 6: Provide Funding for Additional Rounds of Pre-Seed/Seed Funds

Pre-seed/seed funds provide post-angel but pre-venture financing so desperately needed by technology-based entrepreneurs. This stage of funding, which usually requires $250,000 to $2 million in individual investments, constitutes a critical private-sector market gap for investment dollars as the size is usually too small for larger venture funds to consider.

Having dedicated, locally managed, indigenous pre-seed/seed funds is absolutely essential for building the "farm club" of firms, which, as they gain experience and need additional funds to expand, become candidates for "major league" funding from larger, more diversified venture funds both in the region and outside the region. The presence of strong indigenous investment funds is needed to attract outside regional and national funds to invest in Michigan.

Recognizing that building a critical mass of innovative firms is unlikely without pre-seed and seed stage financing, many states and regions have developed programs to increase the availability of early-stage capital. States and regions have taken various approaches such as capitalizing funds that make direct investments in companies, investing in privately managed venture funds, investing pension funds in venture capital, and using tax incentives to encourage investment in venture capital. In some cases, universities and foundations are investing a portion of their endowments in seed and pre-seed funding. A number of states have used state dollars to create such investment funds (see textbox).

What Others Do: Ohio Third Frontier Pre-Seed/Seed Plus Fund Capitalization Program

The state of Ohio, through the Ohio Third Frontier, has also made significant investments to build its indigenous risk-capital base through the Ohio Third Frontier Pre-Seed/Seed Plus Fund Capitalization Program (PCFP). As a result of its program, the Ohio Third Frontier has helped establish Ohio as a leading location for early-stage risk capital investment through the capitalization of multiple Ohio-based Pre-Seed Funds. The goals of the Ohio Third Frontier PCFP are as follows:

- Increase the number of professionally managed Pre-Seed Funds investing throughout Ohio;
- Increase the amount of early-stage capital being invested in Ohio technology-based companies;
- Create a risk capital climate that supports the development, retention, and attraction of investable technology companies in Ohio; and
- Build a pipeline of technology company deal flow that increasingly attracts the resources of venture capital firms both within and outside of Ohio.

Through 2013, the Ohio Third Frontier had invested approximately $65 million in over 30 pre-seed and seed funds across the state of Ohio. These funds, in return, have leveraged over $3 billion in follow-on funding and have created nearly 5,000 jobs.

The 21st CJF has provided funding for several pre-seed funds that has helped to improve the risk capital climate of the state. Similar to the Fund of Funds, now is not the time to withdraw from the risk-capital investment scene. Michigan has made great strides in the amount of risk capital it is now attracting to

the state and having invested in Michigan innovative firms. To continue this trend, additional funding should be provided for more rounds of pre-seed funds. It is recommended that the awards allow for larger rounds with multiple awardees. In addition, the rounds should require higher leverage/match requirements to reflect how the success of the initial rounds has helped to mitigate future risk.

Recommendation 7: Foster Angel Networks and Investments

Angel investor funding represents start-up capital provided by high-net-worth individuals, often retired entrepreneurs and executives, to bridge the gap between funding from friends and family and funding from formal venture-capital funds. These angel investors also are an important source of management advice and contacts for entrepreneurs.

Access to early-stage risk capital is a critical factor in building an innovation economy. One characteristic shared by leading states is that they are home to a network of successful entrepreneurs who act as angel investors, willing to invest in very early-stage start-up companies. Building a base of angel investors able and willing to invest in emerging companies is a challenge for many states. To help overcome this challenge, 20 states offered tax credits to angel investors who invest in technology companies and 12 states provide tax credits to individuals who invest in early-stage venture funds. Michigan is not one of them.

There are ongoing efforts in Michigan to encourage angel investments. However, this activity could be spurred with financial incentives provided by the state. In discussions with some of the individual private-equity investors in Michigan, many mentioned that it is difficult to organize angel investors and to catalyze investment in what are perceived to be riskier ventures due to the lack of a state angel investment tax credit.

What Others Do: Oklahoma i2E

Another longstanding and successful effort in advancing assistance to technology entrepreneurs can be found in Oklahoma, where a nonprofit organization, Innovation to Enterprise (i2E), serves as the outsourced manager of the Oklahoma Technology Commercialization Center. Among its services to entrepreneurs is active vetting of business plans, having on staff serial entrepreneurs to serve as “venture advisors” who collaborate with and mentor entrepreneurs, funding pre-seed and seed investments, offering vouchers to a network of “qualified” professional service providers, advancing strong relationships with angel funders, and helping create angel investor funds. The results of i2E have been impressive, with over 580 companies served since i2E’s formation in 1998. In addition, its initial $20.9 million in pre-seed and seed investments has been leveraged into $478 million in private investment. i2E-assisted companies experienced 31 percent job growth in FY 2013 with an average wage of $73,395, compared with 1.3 percent job growth statewide and an average wage of $38,250.

To help overcome the risk capital shortage, Michigan should enact legislation to create an angel investor tax credit and/or a tax credit that could be provided to investors in early-stage venture funds. In

addition, the state should encourage more formally organized angel networks to aid with coordination, management, due diligence, syndication, etc. (beyond existing small grants to offset administrative costs) by allowing angel funds to compete in pre-seed fund competitions.

Commercialization and Deployment of New Products

The presence of research universities with recognized areas of excellence is critical for regions and states seeking to grow technology-based knowledge economies. Research universities generate knowledge and technology that provide the basis for creating firms and introducing products into the marketplace. Generating new discoveries, however, is necessary but not sufficient for growing knowledge economies.

Universities that succeed in supporting knowledge economies are committed to fostering entrepreneurial development and facilitating commercialization of research findings. Such universities emphasize that faculty roles are not limited to education, research, and public service, but include contributing to economic development as well. These universities are also willing to commit resources to undertake aggressive technology transfer and commercialization efforts.

Traditionally, commercialization of R&D has not been a high priority among universities. However, during the last decade, one after another of the nation's leading research universities have restructured and placed increased emphasis on connecting their R&D capabilities to the commercialization strengths and responsibilities of business. This "connectivity arena" remains more an art than a validated scientific approach; but, as the universities have gained more experience, knowledge, and results, it has become clear that R&D will not "magically" pass over the transom from university to business. Consequently, universities are putting strategies in place to facilitate the commercialization of university discoveries.

Universities and other research institutions find that potential market applications for research findings often go unnoticed unless funding is available to develop an idea or approach, conduct further applied research, undertake due diligence, or expose the research to people with differing perspectives. Prototype-development and proof-of-concept funds are used to address this need. Some universities have established independent entities to commercialize their research findings and to provide assistance including, in some cases, financial assistance to faculty and staff who create new companies around university-developed technologies. Other universities have used their endowments to capitalize local or regional seed and venture funds.

Michigan has had an evolving set of programs and initiatives in terms of its commercialization investments. While a significant amount of initial 21st CJF investments were awarded directly to companies for commercialization efforts with limited results, current plans to invest commercialization funds through intermediaries (universities and in some instances service providers) continue to evolve. The next two recommendations are specific to expanding upon the current commercialization programmatic portfolio.

Recommendation 8: Create Proof-of-Concept Funds

It has become increasingly common for states and/or universities to provide funding for activities needed to determine the commercial potential of a discovery and to advance the technology to the point at which a commercial partner can be found. Proof-of-Concept (PoC) funds support prototype development, testing and validation, and marketing research and are usually provided in the form of a grant that does not require any repayment. Such funding is often needed to commercialize university-owned IP at the highest value—and sometimes to license it at all—as such technology usually is at an early stage of development and requires additional studies or a working prototype before it can be shown to have commercial value. It also is necessary to surround the original discovery with additional patents and protections. Such activities are almost never fundable through conventional peer-reviewed federal programs and, if they are to take place at all, must be separately funded under a different set of

What Others Do: Proof-of-Concept Models

Georgia Research Alliance (GRA) Ventures was created to move university technologies out of the lab and into the marketplace and to grow university-based start-up companies in Georgia. To accomplish these goals, GRA awards the following:

- Phase I grants (up to **$50,000**) to university researchers to answer the question, "Is it commercially feasible to build a company around this technology?"
- Phase II grants (up to **$100,000**) to university researchers to continue prototype development and formulate a company.
- Phase III loans (up to **$250,000**) to companies that have a fully executed license from the university. These companies must also have Georgia-based management. The noncollateralized loan has favorable repayment terms and conditions.

Since 2002, GRA has evaluated the commercial potential of more than 400 inventions or discoveries at universities. The most promising of these were awarded grants to help fund the technology research necessary to further develop the invention or discovery. This process has led to the formation of more than 150 early-stage companies that employ more than 1,300 people and have generated more than $140 million in revenue.

Colorado Bioscience Discovery Evaluation Grant Program (now part of a broader Advanced Industry Accelerator Program). Since 2007, Colorado has provided grant funding to validate the commercial potential of research discoveries and technologies and reach critical commercialization milestones. Under the Bioscience Discovery Evaluation Grant Program, a June 2013 program update to the legislature by the Office of Economic Development and International Trade reported that 163 proof-of-concept grants were made from 2007 to 2013 involving funding of just under $10 million, which led to 38 new companies formed, over $290 million of follow-on capital funding, and 34 licenses issued.

Iowa's Innovation Programs build upon the initial effort of the state-funded Demonstration Fund, with additional federal resources, to support high-technology prototype and concept development activities by small- and-medium-sized companies that have a clear potential to lead to commercially viable products or services. These innovation programs are targeted to assisting companies in the biosciences, advanced manufacturing, and information technology fields. The level of match and whether it is a grant or loan depends on the stage and size of the state's investment. Through 2013, 37 bioscience projects were funded at nearly $4.5 million, which is roughly one-third of the total funds invested. An independent economic and fiscal impact study of the Demonstration Fund's efforts from 2007 to 2012 found that the 127 investments made, totaling about $13 million, generated 600 direct jobs and annual revenue growth of $87 million, based on survey results from 79 of the firms assisted (a number of firms received multiple awards and some closed or eventually declined the investment).

criteria focused mainly on economic development. Companies seeking to develop a product or process also often require funding for PoC activities.

It is recommended that Michigan dedicate funding to support PoC projects at Michigan universities. A PoC fund could provide matching grants of up to $50,000 that could be used to support commercialization activities. The grants would be awarded on a competitive basis to university researchers and/or companies that have licensed technology from a Michigan university that they plan to commercialize. If successful, Michigan may want to consider expanding this program to allow for follow-on and/or larger awards along the lines of the GRA Ventures, which is described in the text box above.

Recommendation 9: Create a Sector-Specific Matching Grant Program

Building connections among and between research institutions, industry, and entrepreneurial endeavors is an important component of advancing sector-specific innovation efforts. It is recommended that funding be provided to create programs to help connect industry with entrepreneurs with innovative ideas that may help to solve unmet needs. Such a program would be sector specific and tied to Michigan's largest industry sectors. The program would develop grants matching every $1 a private company invests in a start-up as a way to commercialize technologies. This would help to create "stickiness" of Michigan's start-up firms, encouraging them to stay in Michigan due to the linkages/partnerships that are developed with major industry players. It would also serve as another source of risk capital to help launch ideas.

Providing Improved Programmatic Oversight and Operational Performance and Management

For the entrepreneurial ecosystem to perform to its maximum capability, efficiency, and capacity, MEDC, as the significant state-level funding mechanism as well as the lead economic-development agency for the state, needs to take the lead and foster and instill among the intermediary organizations within the ecosystem the need to develop a true collaborative system for operational management. The following strategic recommendations are aimed at improving the ability of all entities within the innovation/entrepreneurial ecosystem to collaborate, improve their efficiency and efficacy, and reduce the reporting burden on Michigan's entrepreneurs.

Recommendation 10: Develop a Revised Reporting System Built Around a Customer-Relationship Management Tool That Reduces Redundancy and Effort; Supports Service Provision, Efficiency, and Programmatic Connectivity; and Increases Data Accuracy

As discussed as part of the data inputs to the economic impact analysis and within the situational assessment, the current mechanisms to collect information used by MEDC and the intermediary

organizations within the state's entrepreneurial ecosystem are both limiting and challenged. Data are collected through various mechanisms and surveys, taking the time and effort of both the service providers and the entrepreneur, but are only partly shared among providers; are potentially and often duplicated among providers leading to a variety of inaccuracies (e.g., different service providers working with the same company but using different company names); and provide limited understanding of the actual performance of the entrepreneurs, start-ups, and programs. Furthermore, higher-order information capacities that could foster improved and integrated service delivery and shed light on longitudinal and sector-based performance are missing from the current system(s).

A new and revised reporting system built around a statewide entrepreneurial customer-relationship management (CRM) tool would provide the infrastructural underpinnings for an overall improved management system. Such as system would need to be built around principles such as the following:

- Standardization of the definition of a "client" among the ecosystem's service providers—With different types of service offerings, including educational and informational sessions, a standard level of agreed-upon "engagement" should be established among the service providers before an entrepreneur is entered into the CRM. This will allow for a more concise and usable database.
- Client/entrepreneur "ownership" and core intake information—A single service provider would be responsible for entering a customer into the system and would "own" the client until formally passing the client to another service provider, if warranted. This should not preclude joint service delivery. Additionally, a set of core and consistent intake data, including specific information regarding the company's industry sector and potential product, should be established and captured as each entrepreneur enters the system. A consistent approach to intake will significantly improve the capabilities of the CRM.
- Service-specific client segmentation—While a standard core of information for clients/entrepreneurs will be available and accessible to registered members of the state's ecosystem CRM, the ability to store certain information deemed proprietary or sensitive by the entrepreneur in a "connected" but "separate" component of the CRM, including the ability to limit access from other users of the database, is an absolute requirement. The ability to securely share this separate data, as necessary, with other service providers is also paramount.
- Integrated metrics and mechanisms to update both operational and performance data—A common CRM will improve the significant issue of different service providers having or reporting different information on the same company. A standardized process for annually "connecting" with the entrepreneur to re-establish his/her involvement with the ecosystem of service providers and to update intake and baseline information will be important.

Recommendation 11: Undertake Analysis of Innovation Industry Clusters to Determine How Best to Support Their Unique Sector Needs, Thereby Helping to Create "Stickiness" by Tying Entrepreneurial Efforts to Larger Economy.

Available data begin to show differences by industry sectors or clusters in both the connections to certain types of services and in performance of start-up companies. Whether these differences are due

to product-development life cycles/timing issues or to the unique challenges and competitiveness inherent in different industries, it is important to recognize and understand these differences in the development of service delivery methods and financial mechanisms to support entrepreneurial growth in different industry segments.

At some basis of industry disaggregation, whether at the broad or sector level used in parts of this assessment or some other agreed-upon structure, detailed entrepreneurial agendas, action plans, and integrated but flexible individual entrepreneurial-support strategies tailored, at least in part, to the unique industry requirements facing the start-up company will provide significant value to the new entrepreneur. An added benefit of developing such an "industry-centric" approach will be the ability to link these new start-ups to larger, established firms in the state and to the broader economy. Such an approach may also foster significant opportunities for mentoring relationships and perhaps even customer-supplier relationships as the ultimate measure of success.

Chapter 6: Conclusion

Now is the time for Michigan to reinvest in its commitment to transition the state's economy into a 21st century knowledge economy driven by innovation. When it began its initial investments through the 21st CJF over a decade ago, Michigan was laying the foundation for a sustained, high-growth recovery that would enable the state to "leap forward" and become a leading job- and wealth-generating economy. State leaders understood that, in today's global knowledge-based economy, the recipe for economic success is quite simple—Michigan must focus its economic development efforts to ensure that its existing industry drivers can raise their level of competitiveness and added value and that it can identify new drivers of innovation to improve the state's economic prospects.

Over the past decade, as a result of the investments of the 21st CJF, Michigan has developed and is implementing strategies aimed at growing its technology sectors through innovation and entrepreneurship. A key principle of these investment strategies is that they are all predicated on building on the state's strengths, including its university and industry sectors, and encouraging the growth of new and existing business ventures. A strong entrepreneurial community will be essential to realizing these goals. Entrepreneurs, after all, are the people who turn research findings and discoveries into viable business opportunities. Michigan, however, like most of the industrial Midwest, does not have a long history of technology entrepreneurship and must therefore work to nurture and support aspiring entrepreneurs and, in some cases, attract them to locate in Michigan.

Michigan has a number of efforts in place to support the innovation/entrepreneurial ecosystem. The 21st CJF not only provides support to entrepreneurs, but a variety of programs have been put in place to increase the availability of capital at all stages, and programs have been initiated to help guide innovations through the commercialization and business start-up phase.

These efforts have had a significant impact on the state of Michigan to date, and even more importantly, the innovation/entrepreneurial ecosystem has seen considerable growth and development evidenced by Michigan's rise in a number of key indicators.

The economy of Michigan is at a crossroads—its ability to reshape itself through innovation and entrepreneurship driven by clusters that meet the demands of national and global markets is predicated on its ability to stay the course and continue to make significant investments to improve the entrepreneurial climate of the state. Michigan must not turn back. The time is now to seize this economic development opportunity.

Appendix A—Industry Portfolio Analysis Details

Advanced Manufacturing

Overview

21st CJF Programs/Grantees have made a cumulative net investment of $43.5 million in 224 advanced manufacturing companies, 198 of which were still viable Michigan firms in 2014. In addition, the 21st CJF investments have leveraged an additional $91.7 million in follow-on private risk-capital investments, a leverage ratio of 2.11 to 1.

Economic Impact

In 2014, the 198 advanced manufacturing companies that make up the current investment portfolio contributed to the state's economy in significant ways. These companies generated the following total impacts:

- 9,573 jobs
- $594 million in wages and benefits
- $2.6 billion in total output (economic impact), and
- $65 million in total state and local taxes.

Table A1. Economic Impact of 21st CJF Advanced Manufacturing Portfolio Companies

Impact Type	Employment	Labor Income	Output	State & Local Revenue
Direct Effect	3,896	$305,905,674	$1,629,199,545	$17,824,685
Indirect Effect	2,672	$165,097,224	$545,242,397	$24,390,327
Induced Effect	3,006	$123,302,618	$378,807,663	$22,836,982
Total Impacts	**9,573**	**$594,305,516**	**$2,553,249,604**	**$65,051,994**
Multiplier	*2.46*	*1.94*	*1.57*	

Source: Analysis using IMPLAN State of Michigan impact model.

Return on Investment

The following are results of the cumulative net investment of $43.5 million:

- Every $1 in ***cumulative*** 21st CJF investment leverages additional private-sector innovations and operations resulting in $59 of total ***annual*** economic output for the state of Michigan.
- As of 2014, portfolio companies and their suppliers generated $65.1 million in state and local tax revenues ***annually***, representing a 149 percent return on the total ***cumulative*** investment.

Subsector Impact Summary

The advanced manufacturing sector is significantly large and diverse in Michigan, and the composition of the 21st CJF investments reflect this diversity. Table A2 summarizes the impact analysis on a subsector basis.

Table A2. Summary of Total Impacts from Advanced Manufacturing Subsectors

Subsector	Direct Effects		21st CJF Net Investments	Total Impacts			
	# of Companies	Employment		Employment	Labor Income	Output	State & Local Tax Revenue
Aircraft	3	24	**$3,531,000**	59	$3,942,190	$16,204,161	$344,483
Auto	20	557	**$11,854,719**	1,902	$128,213,581	$745,889,782	$15,883,776
Chemicals & Materials	36	424	**$6,179,714**	1,204	$75,188,564	$384,157,562	$9,374,656
Electronics & Instruments	78	1,652	**$15,721,643**	3,863	$240,020,707	$899,486,999	$24,710,143
Fabricated Metals	11	438	**$3,949,509**	856	$47,209,083	$159,796,925	$4,862,990
Machinery	30	566	**$1,539,160**	1,149	$69,603,886	$222,676,996	$6,416,226
Other	20	236	**$767,716**	538	$29,966,047	$124,311,259	$3,441,168

Source: Analysis using IMPLAN State of Michigan impact model.

Life Sciences

Overview

21st CJF Programs/Grantees have made a cumulative net investment of $86.0 million in 262 life sciences companies, 222 of which were still viable Michigan firms in 2014. In addition, the 21st CJF investments have leveraged an additional $356.6 million in follow-on private risk-capital investments, a leverage ratio of 4.15 to 1.

Economic Impact

In 2014, the 222 life sciences companies that make up the current investment portfolio contributed to the state's economy in significant ways. These companies generated the following total impacts:

- 6,778 jobs
- $440 million in wages and benefits
- $1.5 billion in total output (economic impact), and
- $43 million in total state and local taxes.

Table A3. Economic Impact of 21st CJF Life Sciences Portfolio Companies

Impact Type	Employment	Labor Income	Output	State & Local Revenue
Direct Effect	2,412	$217,531,061	$839,058,225	$9,488,262
Indirect Effect	2,133	$130,779,223	$359,462,628	$16,141,464
Induced Effect	2,233	$91,552,307	$281,337,300	$16,968,891
Total Impacts	**6,778**	**$439,862,591**	**$1,479,858,153**	**$42,598,618**
Multiplier	*2.81*	*2.02*	*1.76*	

Source: Analysis using IMPLAN State of Michigan impact model.

Return on Investment

The following are results of the cumulative net investment of $86.0 million:

- Every $1 in cumulative 21st CJF investment leverages additional private-sector innovations and operations resulting in $17 of total annual economic output for the state of Michigan.
- As of 2014, portfolio companies and their suppliers generated $42.6 million in state and local tax revenues annually, representing a 50 percent return on the total cumulative investment.

Subsector Impact Summary

The life sciences sector has a strong biotech/R&D and medical device context in Michigan, reflected in the composition of the 21st CJF investments. Table A4 summarizes the impact analysis on a subsector basis.

Table A4. Summary of Total Impacts from Life Sciences Subsectors

Subsector	Direct Effects		21st CJF Net Investments	Total Impacts			
	# of Portfolio Companies	Employment		Employment	Labor Income	Output	State & Local Tax Revenue
Agbioscience	6	52	$1,325,436	85	$3,288,158	$15,921,250	$394,108
Pharma & Medical Devices	33	1,065	$13,380,345	3,939	$273,472,276	$1,087,782,470	$28,789,962
Biotech & R&D	167	871	$68,054,619	1,992	$118,924,919	$282,751,772	$9,965,077
Healthcare Services	16	425	$3,249,271	763	$44,177,244	$93,402,688	$3,449,471

Source: Analysis using IMPLAN State of Michigan impact model.

Information Technology (IT/SaaS)

Overview

21st CJF Programs/Grantees have made a cumulative net investment of $18.7 million in 341 IT/SaaS companies, 311 of which were still viable Michigan firms in 2014. In addition, the 21st CJF investments have leveraged an additional $127.7 million in follow-on private risk-capital investments, a leverage ratio of 6.84 to 1.

Economic Impact

In 2014, the 311 information technology companies that make up the current investment portfolio contributed to the state's economy in significant ways. These companies generated the following total impacts:

- 5,661 jobs
- $343 million in wages and benefits

- $808 million in total output (economic impact), and
- $31 million in total state and local taxes.

Table A5. Economic Impact of 21st CJF Information Technology Portfolio Companies

Impact Type	Employment	Labor Income	Output	State & Local Revenue
Direct Effect	2,350	$201,888,973	$410,746,537	$10,523,259
Indirect Effect	1,568	$69,524,533	$177,739,968	$7,420,074
Induced Effect	1,743	$71,449,502	$219,581,598	$13,246,273
Total Impacts	**5,661**	**$342,863,008**	**$808,068,103**	**$31,189,607**
Multiplier	*2.41*	*1.70*	*1.97*	

Source: Analysis using IMPLAN State of Michigan impact model.

Return on Investment

The following are results of the cumulative net investment of $18.7 million:

- Every $1 in *cumulative* 21st CJF investment leverages additional private-sector innovations and operations resulting in $43 of total *annual* economic output for the state of Michigan.
- As of 2014, portfolio companies and their suppliers generated $31.2 million in state and local tax revenues *annually*, representing a 167 percent return on the total *cumulative* investment.

R&D, Engineering, and Technical Services

Overview

21st CJF Programs/Grantees have made a cumulative net investment of $17.4 million in 227 R&D, engineering, and technical services companies, 204 of which were still viable Michigan firms in 2014. In addition, the 21st CJF investments have leveraged an additional $29.2 million in follow-on private risk-capital investments, a leverage ratio of 1.68 to 1.

Economic Impact

In 2014, the 204 R&D, engineering, and technical services companies that make up the current investment portfolio contributed to the state's economy in significant ways. These companies generated the following total impacts:

- 3,597 jobs
- $215 million in wages and benefits
- $511 million in total output (economic impact), and
- $18 million in total state and local taxes.

Table A6. Economic Impact of 21st CJF R&D, Engineering, and Tech Services Portfolio Companies

Impact Type	Employment	Labor Income	Output	State & Local Revenue
Direct Effect	1,572	$125,847,989	$254,790,962	$4,970,672
Indirect Effect	933	$44,165,598	$118,298,781	$4,729,107
Induced Effect	1,092	$44,748,015	$137,520,014	$8,295,741
Total Impacts	**3,597**	**$214,761,603**	**$510,609,757**	**$17,995,519**
Multiplier	*2.29*	*1.71*	*2.00*	

Source: Analysis using IMPLAN State of Michigan impact model.

Return on Investment

The following are results of the cumulative net investment of $17.4 million:

- Every $1 in cumulative 21st CJF investment leverages additional private-sector innovations and operations resulting in $29 of total annual economic output for the state of Michigan.
- As of 2014, portfolio companies and their suppliers generated $18.0 million in state and local tax revenues annually, representing a 103 percent return on the total cumulative investment.

Business, Consumer, and Retail Services

Overview

21st CJF Programs/Grantees have made a cumulative net investment of $1.7 million in 159 business, consumer, and retail services companies, 137 of which were still viable Michigan firms in 2014. In addition, the 21st CJF investments have leveraged an additional $16.0 million in follow-on private risk-capital investments, a leverage ratio of 10.64 to 1.

Economic Impact

In 2014, the 137 business, consumer, and retail services companies that make up the current investment portfolio contributed to the state's economy in significant ways. These companies generated the following total impacts:

- 1,222 jobs
- $47 million in wages and benefits
- $94 million in total output (economic impact), and
- $147 million in total state and local taxes.

Table A7. Economic Impact of 21st CJF Business, Consumer, and Retail Services Portfolio Companies

Impact Type	Employment	Labor Income	Output	State & Local Revenue
Direct Effect	773	$27,886,167	$90,081,419	$5,463,636
Indirect Effect	209	$9,415,607	$27,202,459	$1,210,408
Induced Effect	240	$9,821,512	$30,184,195	$1,820,899
Total Impacts	**1,222**	**$47,123,286**	**$147,468,074**	**$8,494,943**
Multiplier	*1.58*	1.69	1.55	

Source: Analysis using IMPLAN State of Michigan impact model.

Return on Investment

The following are results of the cumulative net investment of $1.7 million:

- Every $1 in *cumulative* 21st CJF investment leverages additional private-sector innovations and operations resulting in $84 of total *annual* economic output for the state of Michigan.
- As of 2014, portfolio companies and their suppliers generated $8.5 million in state and local tax revenues *annually*, representing a 486 percent return on the total *cumulative* investment.