

The Economic and Fiscal Impacts of TEDCO's Five Core Programs

PREPARED BY



**UNIVERSITY OF
BALTIMORE**

Jacob France Institute



TECONOMY
PARTNERS LLC

Executive Summary

Maryland has a twenty-year history of investing in technology-based economic development. Across the nation, states are increasingly taking the lead in promoting entrepreneurship, innovation and technology commercialization as a core focus of their economic development strategy. According to the National Academy of Sciences, Best Practices in State and Regional Innovation Initiatives: Competing in the 21st Century Report,

In the United States, in contrast to a number of other advanced countries, until very recently virtually all initiatives to promote innovation clusters took place at the state and regional level, albeit generally with the benefit of federal R&D funding. States confront stark economic challenges in the global era, including the growing competition from foreign enterprises, often backed by comprehensive government industrial policies, erosion of traditional manufacturing sectors, the wholesale movement offshore of industrial chains, rising unemployment and ultimately, declining population. Efforts at industrial revival using traditional policy tools, including industrial recruitment and financial incentives to industry are now being complemented by more technology-based indigenous growth strategies. Since the early 1990s, a number of states have increasingly viewed support for innovation clusters as a leading policy tool for fostering the international competitiveness of local industries.¹

Created in 1998 by Maryland State Legislature to facilitate the transfer and commercialization of technology from Maryland's research universities and federal labs into the marketplace and to assist in the creation and growth of technology-based businesses in all regions of the State, TEDCO has been supporting the development and expansion of Maryland's entrepreneurial and innovation driven economy.

TEDCO's programs have supported the development of a large, diverse and growing portfolio of companies that supports the growth and diversification of the Maryland economy. TEDCO's current portfolio of assisted companies has grown from 223 companies with 1,147 jobs in the 2013 study to 253 companies with 1,739 jobs in the 2015 study to 326 companies with 3,108 jobs in 2018 (289 companies and 1,934 jobs not counting the Maryland Venture Fund (MVF) – which TEDCO assumed management of in 2016).²

Maryland has received significant and growing economic benefits from its investment in TEDCO. When multiplier effects are included, the five core TEDCO programs generated a total of \$1.6 billion in Maryland economic activity in 2018, supporting a total of 7,746 jobs earning \$600.1 million in labor income and generating estimated state and local government revenues of \$66.6 million. As a result of both the development of new programs and the assumption of management of the MVF, TEDCO's impacts have increased significantly since the first economic impact study was prepared in 2013, with current total impacts of \$1.6 billion and 7,746 jobs well above the \$1 billion and 4,358 jobs in the 2015 report and \$566 million and 2,835 jobs in the 2013 report.

¹ <https://www.nap.edu/catalog/18364/best-practices-in-state-and-regional-innovation-initiatives-competing-in>.

² The difference between the 3,152 Direct Impact jobs and the 3,108 jobs in the 326 TEDCO portfolio companies is the 44 jobs directly created by MSCRF and MII research expenditures.

Figure 3: TEDCO Job Impacts by Year

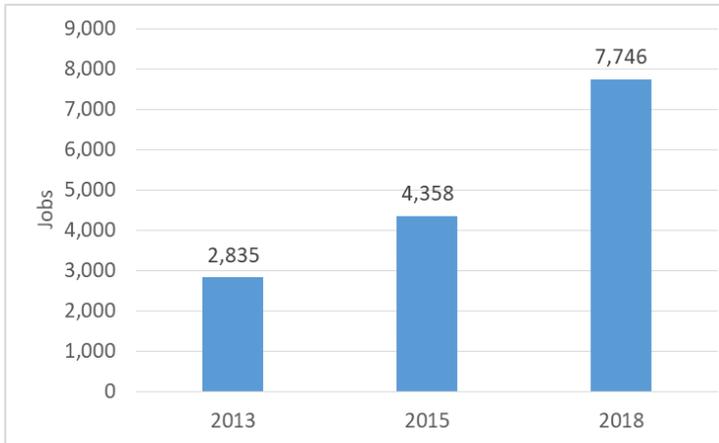
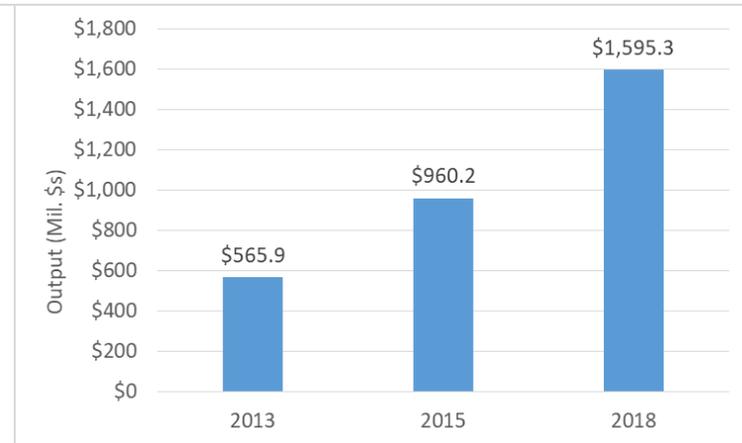


Figure 4: TEDCO Output Impacts by Year



Maryland has received a strong return on its investment in TEDCO. Based on the IMPLAN estimated 2018 combined state and local government revenues of \$66.6 million, the JFI-TEconomy Team estimates the total Maryland state government portion to be \$37.6 million in 2018, an amount twice TEDCO’s FY2018 state appropriation of \$18.5 million. The JFI TEconomy Team also calculated an estimated 2018 return on investment of the State of Maryland’s investment in TEDCO’s MII, MBPF and Seed Investment Funds and found that focusing narrowly on the estimated state tax revenues associated with three programs, the 2018 return on the State investment in TEDCO totals 23 percent.³

TEDCO makes a significant and growing contribution to the Maryland economy. TEDCO’s economic impact was not analyzed as a simple source of expenditures because it serves as a mechanism for the state to *invest* in research, technology commercialization, the start-up of new companies, and the expansion of existing companies in new and leading technology areas. As a source of investment, TEDCO’s operations create a “portfolio” of activities that continues to provide returns to the State of Maryland in the form of new jobs, new and expanded companies, and new product revenues. Across the nation, competitor states are similarly investing in both their innovation economies and entrepreneurial ecosystems in order to grow their economies. Maryland, with leading federal, university and private research assets, a skilled and educated workforce, and a strong position in technology development and innovation, is well positioned to compete nationally and globally across multiple technology and innovation areas. TEDCO plays a central role in supporting the local generation, commercialization, development, production and sale of the technologies and products of tomorrow.

³ This return on investment analysis excludes the MSCRF because it is focused on research and cannot be expected to generate near term returns and MVF because the core operating costs are generated internally to the fund.

Contents

Executive Summary	1
Introduction	4
TEDCO's Mission	4
JFI-TEconomy Approach to Measuring the Economic Impact of TEDCO	5
Total Direct Impacts: TEDCO's Five Core Programs.....	6
The Economic Impact of TEDCO's Five Core Programs	8
TEDCO's Overall Impact	8
Total Estimated Economic Impacts – Program-Specific	10
Economic Impacts of the Maryland Innovation Initiative.....	10
Economic Impacts of the Maryland Stem Cell Research Fund	10
Economic Impacts of the Maryland Venture Fund	11
Economic Impacts of the Minority Business Pre-seed Fund.....	12
Economic Impacts of the Seed Investment Funds.....	12
Projected 2023 Impacts of TEDCO's Five Core Programs	13
Summary and Conclusion	14
Appendix – Economic Impact Methodology	16

Introduction

TEDCO retained the team of the Jacob France Institute and TEconomy Partners to update the economic and fiscal impact portions of its 2013 and 2015 economic impact reports.⁴ This report assesses only the economic and fiscal contributions of TEDCO's portfolio of companies and programs, not the full functional and strategic impacts covered in the prior reports. See the Appendix for a description of the methodology used in this report.

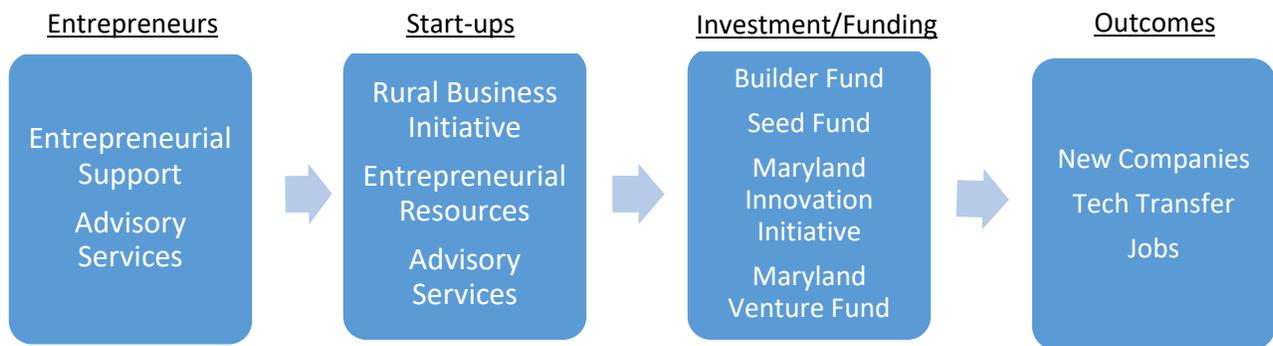
TEDCO's Mission

TEDCO was created by the Maryland State Legislature in 1998 to facilitate the transfer and commercialization of technology from Maryland's research universities and federal labs into the marketplace and to assist in the creation and growth of technology-based businesses in all regions of the state. TEDCO's mission is to, *"Enhance economic development growth through the fostering of an inclusive entrepreneurial and innovation ecosystem. Discover, invest in, and help build great Maryland-based, technology companies."* TEDCO fulfills its mission by providing technical assistance to and investing in start-up and early-stage companies in Maryland and supporting Maryland's strong research capabilities.

TEDCO operates across the key areas of innovation-driven entrepreneurial growth. Within Maryland's innovation ecosystem, the generation of new ideas, products and technologies through **research and development** is the core driver of technology growth in the state. The discovery of new technologies and products alone is not enough to promote innovation led economic growth, new discoveries must be transformed into commercial products and processes through the **technology commercialization** process. Finally, companies must **invest** in the productive capacity, both physical plant (offices, labs, factories) and talent (workforce), to produce and sell new technology-based products or services in the global marketplace. TEDCO is active in all of these critical steps in the innovation process. Through the *Maryland Stem Cell Research Fund*, TEDCO supports basic research, translational research, clinical studies, and technology commercialization in the key emerging area of stem cells. The *Maryland Innovation Initiative* invests in promising university technologies and companies formed to commercialize those technologies. TEDCO's *Minority Business Pre-seed Fund*, *Seed Investment Funds* and *Maryland Venture Fund* programs help to provide the investment necessary to start, grow and retain entrepreneurial, innovation-driven companies in Maryland. Across the entire innovation process, TEDCO provides access to advisory and technical support services to support technology-led economic development in the State.

⁴ The 2013 and 2015 *Economic and Programmatic Impacts of the Maryland Technology Development Corporation on the Maryland Economy* reports were prepared by the Battelle Technology Partnership Practice – TEconomy Partners is the successor to this organization and the principal investigator on these projects is now the Director of the JFI.

Figure 1: TEDCO's Core Entrepreneurial/Business Programs



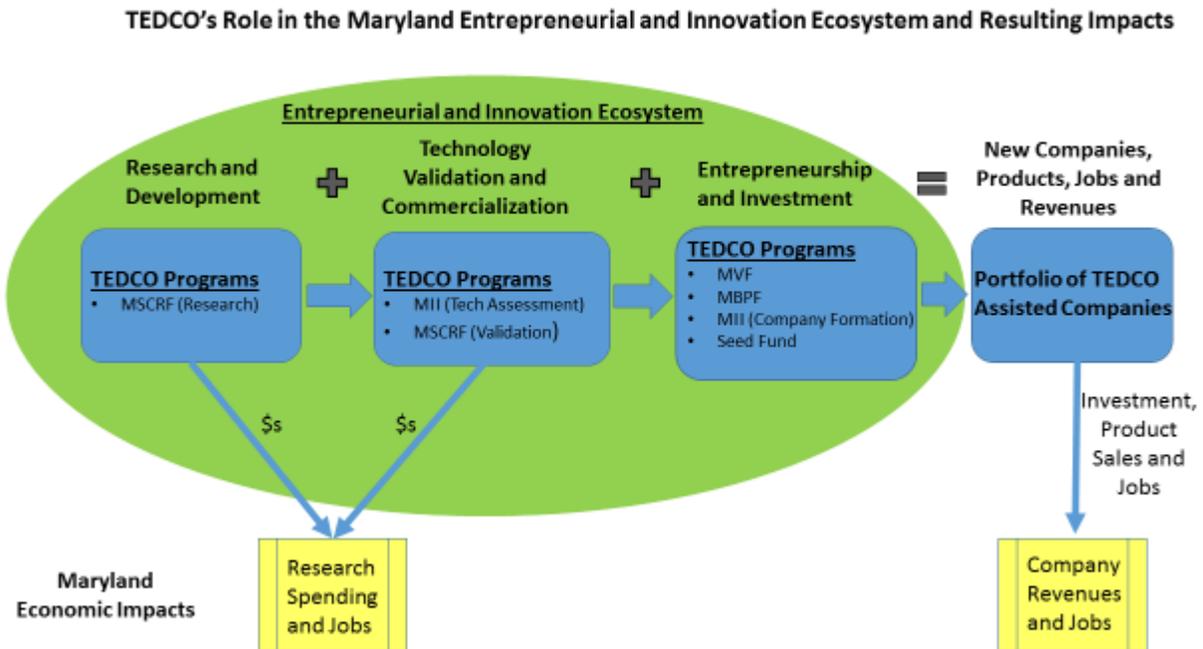
As described above, TEDCO provides important services to Maryland's entrepreneurial and innovation ecosystem. According to TEDCO's most recent annual report, key measures of TEDCO's operations and outcomes include:

- Six active mentoring and education programs in place;
- Eight active funding programs in place;
- More than 400 seed investments made totaling more than \$22 million;
- Supported the creation of a portfolio of 326 active companies in Maryland;
- Leveraged more than \$1 billion in follow-on venture capital investment in the portfolio of companies supported; and
- Supported \$144 million in 436 stem cell research grants through MSCRF, keeping Maryland at the forefront of research in this critical future growth area.

JFI-TEconomy Approach to Measuring the Economic Impact of TEDCO

The JFI-TEconomy Team's approach to analyzing the economic contribution of technology-based economic development programs is presented in Figure 2. Broadly speaking, the *Maryland Entrepreneurial and Innovation Ecosystem* consists of the generation of new products, processes and technologies through *research and development*; the transformation of these technologies into products through *technology commercialization*; and the development and sale of new products and technologies in the global marketplace through the start-up of new companies and investment by existing companies through *entrepreneurship and investment*. TEDCO is active in all of these three key phases, resulting in the development of a "portfolio" of supported companies and research activities.

Figure 2: Economic Impact Analysis Approach



The JFI-TEconomy Team’s approach to assessing the economic and fiscal contribution of these programs is to quantify the direct impacts of TEDCO’s programs in terms of the research expenditures supported through the Maryland Stem Cell Research Fund and Maryland Innovation Initiative (MII-Tech Assessment) and the portfolio of active companies supported by the MII-Company Formation, Maryland Venture Fund (MVF), Minority Business Pre-seed Fund (MBPF), and Seed Investment funds. As described in the methodology section below, these direct impacts were the inputs to this economic and fiscal impact analysis.

Total Direct Impacts: TEDCO’s Five Core Programs

The JFI-TEconomy Team used the IMPLAN model for the State of Maryland to estimate the economic and fiscal impacts associated with TEDCO’s five core programs. The IMPLAN input-output model can be used to estimate the economic and fiscal contributions of projects, companies or of entire industries on a state, regional, or county economy. An IMPLAN analysis can be based on the revenues and/or the jobs associated with an event, program or an industry. The inputs to the economic and fiscal impact analysis are the research activities funded by and employment and business activities of the portfolio of companies that have received support from TEDCO’s five core research, technology commercialization and investment programs. The direct impacts of the five core TEDCO programs are presented in Table 1, and consist of the following:

- The direct impacts of the MII-Company Formation, MVF, MBPF, and Seed Investment programs were the current employment levels of the portfolio of companies assisted currently active in Maryland.⁵ For MII-Tech Assessment, the research, development and commercialization support

⁵ TEDCO provided data on the 49 MII, 61 MVF, 9 MBPF and 126 Seed Investment Fund companies currently tracked in its management information system. In order to be comparable to the approach used in and results of the prior 2013 and 2015 analyses, the JFI added to this analysis the companies from the Technology Commercialization Fund (TCF) and Cyber Security Investment Fund (CIF) that are now part of the Seed Investment Fund and any older MII companies

provided to each project’s university partners was also included. The employment and IMPLAN-estimated revenues of this portfolio of companies represent the direct impact of TEDCO’s core business investment programs; and

- The direct impacts of the MCRF and MII (Tech Assessment) were the research expenditures associated with the program, which were analyzed as occurring in the R&D sector of the Maryland economy.

TEDCO has supported the development of an expanding portfolio of companies and research activities in Maryland. The direct Maryland economic activity generated by the five core programs analyzed totals almost \$900 million in economic activity and 3,152 jobs in 2018, up significantly from \$572.3 million in economic activity and 1,916 jobs in 2015. While a large share of this growth can be attributable to the inclusion of the Maryland Venture Fund which TEDCO assumed control over in 2016, the direct impacts of TEDCO’s long term, MII, MSCRF, and Seed Investment Funds generate 63 percent of these impacts, with these three programs experiencing 11 percent growth in direct employment since 2015. TEDCO’s Seed Investment Fund has the largest direct impact, accounting for 53 percent of jobs, followed by the MVF with 37 percent.

Table 1: Direct Maryland Impacts Associated with TEDCO's Five Core Programs - FY2018

	Revenues or Expenditures	Employment
Five Core TEDCO Programs ²	<u>\$889,839,159</u>	<u>3,152</u>
Maryland Innovation Initiative ²	\$75,705,527	245
Maryland Stem Cell Research Fund ³	\$8,660,901	30
Maryland Venture Fund ²	\$330,718,511	1,181
Minority Business Pre-seed Fund	\$934,344	16
Seed Investment Funds	\$473,819,876	1,680

Source: JFI analysis of TEDCO data.

no longer tracked by TEDCO based on the portfolio of companies used in the 2015 report, yielding a total of 432 TEDCO assisted companies. The 43 TEDCO assisted companies that are now located out of state were excluded from this analysis, as were 63 companies where no operating information could be located, yielding a portfolio of 326 currently active, TEDCO-supported, Maryland companies. The JFI identified the current levels of employment and industry of these companies through a combination of TEDCO provided data, commercial databases, and web searches. Where data were not available, company industry and/or employment were estimated by the JFI.

The Economic Impact of TEDCO’s Five Core Programs

This section presents the results of the economic impact analyses for the five core programs in aggregate, with the discreet program by program results presented below that. For each analysis, the JFI-TEconomy Team provides the direct effect values driving the model (based upon the operational data provided by TEDCO and refined by the JFI-TEconomy Team), the additional estimated, indirect, and induced multiplier impacts, and a summation of the total impacts (direct, indirect, and induced). An impact multiplier is also provided for the three model drivers (employment, labor income, and output)—for every one job or dollar of direct effect, the multiplier number will equal the total (including the direct effect) number of jobs or dollars created in the regional economy. The following impact data are provided for each analysis: output, labor income (including both wages and benefits), employment, state and local tax revenue, and federal tax revenue.⁶

TEDCO’s Overall Impact

As presented in Table 2, the economic contribution to the Maryland economy of the five core TEDCO programs totaled almost \$1.6 billion in 2018, with a total of 7,746 jobs earning \$600.1 million in labor income and supporting estimated state and local government revenues of \$66.6 million. Total direct research expenditures and portfolio company revenues of \$889.8 million in economic activity and employment of 3,152 are augmented with an additional \$335.2 million in economic activity and 2,057 jobs in the form of *Indirect Impacts* through the local purchases made to support TEDCO’s portfolio of research and supported companies and by \$370.3 million in economic activity and 2,536 jobs in the form of *Induced Impacts* resulting from the increase in local incomes attributable to TEDCO’s five core programs. The \$1.6 billion in estimated TEDCO-supported impacts results in an output multiplier of 1.79, or \$1.79 in economic activity supported for each \$1 in research expenditures and portfolio company revenues.

Table 2: Economic Impact of TEDCO’s Five Core Programs on Maryland – In Aggregate

	Output (\$s)	Labor Income (\$s)	Employment	State/Local Tax Revenue (\$s)	Federal Tax Revenue (\$s)
Direct Effect	\$889,839,159	\$339,092,154	3,152	\$25,816,771	\$75,863,265
Indirect Impacts	\$335,177,856	\$134,559,898	2,057	\$15,948,040	\$30,197,408
Induced Impacts	\$370,276,510	\$126,435,516	2,536	\$24,857,701	\$31,110,502
Total Impact	\$1,595,293,525	\$600,087,568	7,746	\$66,622,512	\$137,171,175
State Impact Multiplier	1.79	1.77	2.46		

Source: JFI calculations using IMPLAN I/O model for the State.

⁶ The estimation of tax revenue is subject to significant variability due to ever-changing rate structures, the use of available exemptions, and the accounting of potential income, if any, subject to taxation. These figures should be viewed with some measure of caution throughout this analysis.

The Maryland impacts associated with TEDCO’s core operations has grown with the State’s investment.

While the addition of the MVF to TEDCO’s core operations in 2016 accounts for a significant share of the growth, TEDCO’s expanding role in and impact on the State’s economy is evident in the growth in estimated impacts from the prior two analyses of TEDCO’s impacts, with current total impacts of \$1.6 billion and 7,746 jobs well above the \$1 billion and 4,358 jobs in the 2015 report⁷ and \$566 million and 2,835 jobs in the 2013 report⁸ (Figures 3 and 4). The Seed Investment program accounts for 52 percent of the total Maryland impacts associated with TEDCO, followed by MVF at 38 percent, MII at 8 percent, and MSCRF at 1 percent (Table 3).

Figure 3: TEDCO Job Impacts by Year

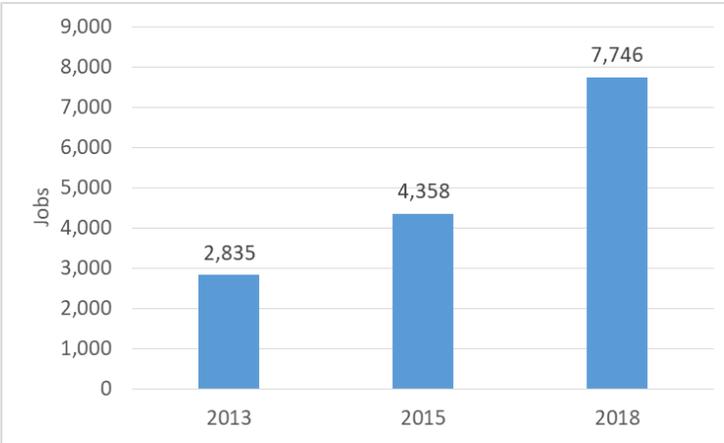


Figure 4: TEDCO Output Impacts by Year

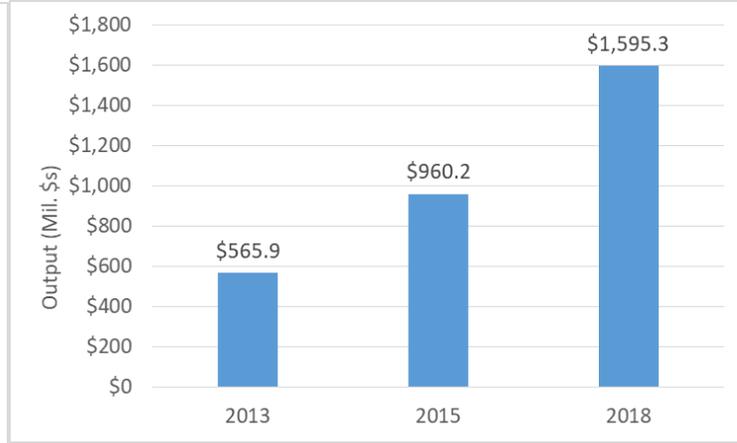


Table 3: TEDCO’s Total Maryland Employment and Output Impact 2018, by Program

Program/Impact	Employment (Jobs)	Output (Mil. \$s)
Total	<u>7,746</u>	<u>\$1,595.3</u>
Maryland Innovation Initiative	616	\$133.5
Maryland Stem Cell Research Fund	83	\$16.7
Maryland Venture Fund	2,995	\$607.5
Minority Business Pre-seed Fund	22	\$1.9
Seed Investment Funds	4,029	\$835.8

Source: JFI calculations using IMPLAN I/O model for the State.

⁷ Five programs analyzed – MII, MSCRF, the Technology Commercialization Fund (TCF) and Cyber Security Investment (CIF) Fund and Propel Baltimore Fund. TCF and CIF are now core components of the Seed Investment Fund and PBF has been discontinued.

⁸ Three programs analyzed -- MSCRF, TCF and MII.

Total Estimated Economic Impacts – Program-Specific

Economic Impacts of the Maryland Innovation Initiative

The Maryland Innovation Initiative (MII) was created as a partnership between the State of Maryland and five Maryland academic research institutions (Johns Hopkins University, Morgan State University, University of Maryland College Park, University of Maryland Baltimore and University of Maryland Baltimore County.) The program is designed to promote commercialization of research conducted in the partnership universities and leverage each institution’s strengths. The Maryland Innovation Initiative was created to foster the transition of promising technologies having significant commercial potential from the five participating universities, where they were discovered, to the commercial sector, where they can be developed into products and services that meet identified market needs. The MII promotes commercialization through technology validation, market assessment, and the creation of start-up companies in Maryland based on university discovered technology. MII provides up to \$265,000 in project funding in a two phase process:

- Technology Assessment - Technology Validation and Market Assessment, 9 months, up to \$115,000; and
- Company Formation - Commercial Launch, 9 months, up to \$150,000.

The JFI analyzed the economic impacts associated with the portfolio of 50 currently active MII companies with direct employment of 229 workers. The JFI also analyzed the economic activity associated with the \$4.5 million in MII Phase 1 Technology Assessment research and development activity provided to the five partner universities in FY 2018. As presented in Table 4, the \$75.7 million in estimated MII portfolio company revenues and associated research expenditures generates \$133.5 million in economic activity in Maryland, supports 616 jobs earning \$46.9 million in labor income, and have an associated \$5.2 million in estimated state and local government revenues. The MII portfolio of companies and research direct impacts are augmented with an additional \$28.9 million in economic activity and 174 jobs in the form of *Indirect Impacts* through the local purchases made to support the operations of these companies and research projects and by \$28.9 million in economic activity and 198 jobs in the form of *Induced Impacts* from the increase in local incomes attributable to portfolio and supplier company operations. The \$133.5 million in estimated MII-supported impacts results in an output multiplier of 1.76, or \$1.76 in economic activity supported for each \$1 in associated company revenues/research expenditures.

Table 4: Maryland Innovation Initiative Impact

	Labor			State/Local Tax Revenue (\$s)	Federal Tax Revenue (\$s)
	Output (\$s)	Income (\$s)	Employment		
Direct Effect	\$75,705,527	\$25,383,371	245	\$1,799,945	\$6,030,449
Indirect Impacts	\$28,890,175	\$11,594,234	174	\$1,417,599	\$2,607,303
Induced Impacts	\$28,915,572	\$9,873,598	198	\$1,941,054	\$2,429,458
Total Impact	\$133,511,274	\$46,851,203	616	\$5,158,598	\$11,067,210
State Impact Multiplier	1.76	1.85	2.52		

Source: JFI calculations using IMPLAN I/O model for the State.

Economic Impacts of the Maryland Stem Cell Research Fund

The Maryland Stem Cell Research Fund (MSCRF) promotes state-funded stem cell research and cures through grants to both public and private entities in Maryland. Established by the governor and the Maryland General Assembly through the Maryland Stem Cell Research Act of 2006, the MSCRF was not created specifically to be a pure job-creation program as much as a pathway to medical breakthroughs

using this novel science. As presented in Table 5, the \$8.7 R&D activities associated with the Maryland Stem Cell Research Fund generate \$16.7 million in economic activity in Maryland, support 83 jobs earning \$6.5 million in labor income, and have an associated \$0.7 million in estimated state and local government revenues. Total direct research expenditures of \$8.7 million and direct employment of 30 research jobs are augmented with an additional \$4.0 million in economic activity and 25 jobs in the form of *Indirect Impacts* through the local purchases made to support this research activity and by \$4.0 million in economic activity and 28 jobs in the form of *Induced Impacts* from the increase in local incomes attributable to these research expenditures. The \$16.7 million in estimated MSCRF-supported impacts results in an output multiplier of 1.92, or \$1.92 in economic activity for each \$1 in State of Maryland supported research expenditures.

Table 5: Maryland Stem Cell Research Fund Impact

	Output (\$s)	Labor		State/Local	Federal Tax
		Income (\$s)	Employment	Tax Revenue (\$s)	Revenue (\$s)
Direct Effect	\$8,660,901	\$3,526,585	30	\$196,568	\$780,973
Indirect Impacts	\$3,991,078	\$1,611,033	25	\$183,868	\$361,334
Induced Impacts	\$4,016,398	\$1,371,449	28	\$269,631	\$337,456
Total Impact	\$16,668,377	\$6,509,067	83	\$650,067	\$1,479,763
State Impact Multiplier	1.92	1.85	2.72		

Source: JFI calculations using IMPLAN I/O model for the State.

Economic Impacts of the Maryland Venture Fund

The Maryland Venture Fund (MVF) is an early-stage, evergreen venture capital fund dedicated to funding and growing the next generation of outstanding businesses in Maryland. MVF is managed by experienced team with significant operating and venture experience whose focus is on making the entrepreneurs successful. With more than \$100 million in assets under management, MVF partners with exceptional entrepreneurs and help them build valuable companies that last. As presented in Table 5, the portfolio of 37 active Maryland companies in which MVF has invested have direct Maryland employment of 1,181 workers and estimated revenues of \$330.7 million. The MVF portfolio's impacts are augmented with an additional \$134.2 million in economic activity and 838 jobs in the form of *Indirect Impacts* through the local purchases made to support the operations of these companies and by \$142.6 million in economic activity and 976 jobs in the form of *Induced Impacts* from the increase in local incomes attributable to portfolio and supplier company operations. Including multiplier effects, these companies generate \$607.5 million in economic activity in Maryland, support 2,995 jobs earning \$231.1 million in labor income, and have an associated \$25.0 million in estimated state and local government revenues. The \$607.7 million in estimated MVF-supported impacts results in an output multiplier of 1.84, or \$1.84 in economic activity supported for each \$1 in associated company revenues.

Table 5: Maryland Venture Fund Impact

	Output (\$s)	Labor Income		State/Local Tax	Federal Tax
		(\$s)	Employment	Revenue (\$s)	Revenue (\$s)
Direct Effect	\$330,718,511	\$129,185,508	1,181	\$9,114,827	\$28,013,013
Indirect Impacts	\$134,194,829	\$53,212,378	838	\$6,357,244	\$11,936,379
Induced Impacts	\$142,553,794	\$48,676,696	976	\$9,570,581	\$11,977,399
Total Impact	\$607,467,134	\$231,074,582	2,995	\$25,042,652	\$51,926,791
State Impact Multiplier	1.84	1.79	2.54		

Source: JFI calculations using IMPLAN I/O model for the State.

Economic Impacts of the Minority Business Pre-seed Fund

TEDCO’s Minority Business Pre-seed Fund (MBPF) is a collaboration with Harbor Bank Community Development Corporation (CDC) to invest in African-American led businesses. The Harbor Bank CDC agreed to match TEDCO’s investments of \$20,000 into up to 10 companies giving each company \$40,000. This fund has a focus on investing in these companies due to their lack of access to formal and informal capital. The MBPF provides not only investments, but also access to educational resources, bi-weekly meetings, and business development help from TEDCO staff members to support business operations and growth. As presented in Table 6, the portfolio of 9 active Maryland companies in which MBPF has invested have direct employment of 16 workers and estimated revenues of \$0.9 million. The MBPF portfolio’s direct impacts are augmented with an additional \$0.5 million in economic activity and 3 jobs in the form of Indirect Impacts through the local purchases made to support the operations of these companies and by \$0.4 million in economic activity and 3 jobs in the form of Induced Impacts from the increase in local incomes attributable to portfolio and supplier company operations. When multiplier effects are included, these companies generate \$1.9 million in economic activity in Maryland, support 22 jobs earning \$0.7 million in labor income, and have an associated \$0.1 million in estimated state and local government revenues. The \$1.9 million in estimated MBPF-supported impacts results in an output multiplier of 2.02, or \$2.02 in economic activity supported for each \$1 in associated company revenues.

Table 6: Minority Business Pre-seed Fund Impact

	Output (\$s)	Labor Income (\$s)	Employment	State/Local Tax Revenue (\$s)	Federal Tax Revenue (\$s)
Direct Effect	\$934,344	\$311,293	16	\$24,683	\$63,995
Indirect Impacts	\$538,516	\$224,512	3	\$21,755	\$48,597
Induced Impacts	\$417,492	\$142,555	3	\$28,048	\$35,081
Total Impact	\$1,890,352	\$678,360	22	\$74,486	\$147,673
State Impact Multiplier	2.02	2.18	1.39		

Source: JFI calculations using IMPLAN I/O model for the State.

Economic Impacts of the Seed Investment Funds

TEDCO’s Seed Investment Funds, which include the Technology Commercialization Fund, the Cybersecurity Investment fund, the Life Science Investment Fund, and the Gap Investment Fund, were created to support technology-based businesses in Maryland seeking targeted seed investments. TEDCO makes investments in companies that represent good opportunities to grow strong, sustainable businesses in Maryland. The Funds exist to support businesses that have the potential to scale, to create jobs, and to provide a return on investment to the State. As presented in Table 6, the portfolio of 230 active Maryland companies that have received Seed Fund investments have direct employment of 1,680 workers and estimated revenues of \$473.8 million. The SEED fund portfolio’s direct impacts are augmented with an additional \$167.6 million in economic activity and 1,018 jobs in the form of *Indirect Impacts* through the local purchases made to support the operations of these companies and by \$194.4 million in economic activity and 1,331 jobs in the form of *Induced Impacts* from the increase in local incomes attributable to portfolio and supplier company operations. When multiplier effects are included, these companies generate \$835.8 million in economic activity in Maryland, support 4,029 jobs earning \$315.0 million in labor income, and have an associated \$35.7 million in estimated state and local government revenues. The \$835.8 million in estimated Seed Investment Funds-supported impacts results in an output multiplier of 1.76, or \$1.76 in economic activity supported for each \$1 in associated company revenues.

Table 7: Seed Investment Funds Impact

	Output (\$s)	Labor Income (\$s)	Employment	State/Local Tax Revenue (\$s)	Federal Tax Revenue (\$s)
Direct Effect	\$473,819,876	\$180,685,397	1,680	\$14,680,748	\$40,974,835
Indirect Impacts	\$167,563,258	\$67,917,741	1,018	\$7,967,574	\$15,243,795
Induced Impacts	\$194,373,254	\$66,371,218	1,331	\$13,048,387	\$16,331,108
Total Impact	\$835,756,388	\$314,974,356	4,029	\$35,696,709	\$72,549,738
State Impact Multiplier	1.76	1.74	2.40		

Source: JFI calculations using IMPLAN I/O model for the State.

Projected 2023 Impacts of TEDCO’s Five Core Programs

TEDCO’s operations generate an expanding portfolio of research and companies assisted. The impacts associated with TEDCO’s operations increases as the portfolio of TEDCO-assisted companies grows through two mechanisms: 1) employment growth of the existing portfolio companies; and 2) the addition of new companies assisted by TEDCO’s core programs. The JFI-TEconomy Team projected the five-year growth in the economic impacts associated with TEDCO’s five core programs and their resultant research, commercialization activities, and company operational activities based on the following assumptions:

- Based on the assumptions used in the past two reports, the existing portfolio of companies will experience four percent annual growth in employment⁹;
- The MII will invest in 10 companies per year, each with a starting employment of four jobs per company with current Phase 1 spending held stable;
- The MPBF will invest in 10 companies per year, each with a starting employment of one job per company;
- The MVF will invest in 14 new start-ups per year, each with a starting employment of five jobs per company; and
- The Seed Investing program will invest in 18 companies per year with a starting employment of three jobs per company.

As presented in Table 9, the economic contribution to the Maryland economy of TEDCO’s five core programs is projected to grow to \$2.4 billion in 2023, supporting a total of 11,812 jobs earning \$914.1 million in Labor Income, and generate state and local government revenues of \$101.4 million.

Table 9: TEDCO 5 Core Program Projected 2023 Impacts

	Output (\$s)	Labor Income (\$s)	Employment	State/Local Tax Revenue (\$s)	Federal Tax Revenue (\$s)
Direct Effect	\$1,358,381,768	\$513,745,365	4,776	\$39,007,717	\$114,987,425
Indirect Impacts	\$517,324,800	\$207,766,391	3,173	\$24,556,429	\$46,587,744
Induced Impacts	\$564,011,388	\$192,588,641	3,863	\$37,864,118	\$47,388,103
Total Impact	\$2,439,717,956	\$914,100,397	11,812	\$101,428,264	\$208,963,272
State Impact Multiplier	1.80	1.78	2.47		

Source: JFI calculations using IMPLAN I/O model for the State.

⁹ This 4% rate is higher than the experience of the core portfolio of TEDCO assisted companies since 2015, but well below levels of portfolio growth since portfolio since 2013.

The projected five-year growth in the economic impacts associated with TEDCO's five core programs from \$1.6 billion in economic activity and 7,807 jobs currently to \$2.4 billion and 11,812 jobs in 2023 represents a more than 50 percent increase in TEDCO-supported economic activity and employment. This analysis is based on current levels of state support and funding and MVF investing.

Summary and Conclusion

TEDCO makes a significant and growing contribution to the Maryland economy. TEDCO's economic impact was not analyzed as a simple source of expenditures because it serves as a mechanism for the state to ***invest*** in research, technology commercialization, the start-up of new companies, and the expansion of existing companies in new and leading technology areas. As a source of investment, TEDCO's operations create a "portfolio" of activities that continues to provide returns to the State of Maryland in the form of new jobs, new and expanded companies, and new product revenues. Across the nation, competitor states are similarly investing in both their innovation economies and entrepreneurial ecosystems in order to grow their economies. Maryland, with leading federal, university and private research assets, a skilled and educated workforce, and a strong position in technology development and innovation, is well positioned to compete nationally and globally across multiple technology and innovation areas. TEDCO plays a central role in supporting the local generation, commercialization, development, production and sale of the technologies and products of tomorrow.

By supporting entrepreneurship and innovation in Maryland, TEDCO generates significant economic and fiscal returns to the state. These include:

- TEDCO has supported the development of a portfolio of 326 cutting edge Maryland companies with 3,115 jobs;
- TEDCO's five core programs generated \$1.6 billion in economic activity in 2018, supporting 7,807 jobs earning \$605.3 million in labor income, and generating estimated state and local government revenues of \$67.2 million; and
- TEDCO's impacts have grown with the State of Maryland's investment in the program, with current total impacts of \$1.6 billion and 7,807 jobs well above the \$1 billion and 4,358 jobs in the 2015 report and \$566 million and 2,835 jobs in the 2013 report.

Based on the IMPLAN estimated 2018 combined state and local government revenues of \$66.6 million, the JFI-TEconomy Team estimates the total Maryland state government portion to be \$37.6 million¹⁰ in 2018. These estimated state tax revenues are more than twice TEDCO's FY2018 state appropriation of \$18.5 million. Approximately \$23.1 million of those state tax revenues are attributable to MII, MPBF and Seed Investment Funds, TEDCO's core commercialization and technology support and investment programs. As of fiscal 2018, the State of Maryland has invested a total of \$248 million in TEDCO – not including the MVF. Forty percent of state funding, \$100 million, has supported TEDCO's core technology transfer and investment programs (not including MVF), with 60 percent going to the Maryland Stem Cell Research Fund. The JFI TEconomy Team calculated an estimated 2018 return on investment of the State of Maryland's investment in TEDCO's three core programs, MII, MBPF and Seed Investment Funds. This return on investment analysis excludes the MSCRF because that is an investment in early-stage, translational research

¹⁰ The IMPLAN model used estimates of total ***combined*** state and local revenues from a variety of major revenue sources, including income, property and sales taxes and other revenues. The JFI-TEconomy Team distributed these IMPLAN estimated combined state and local revenues into their separate state and local revenue component estimates based on the distribution of state versus local revenues derived by each major revenue source from the U.S. Bureau of the Census *2016 State & Local Government Finance Historical Datasets and Tables: 2016 data*.

and thus cannot be expected to generate immediate economic and fiscal returns to the state. Furthermore, MVF is excluded from this analysis – because while it is overseen by TEDCO, it is an evergreen investment fund, with key management functions funded by internal returns and fees, and does not receive an allocation from TEDCO’s annual State appropriation. Focusing narrowly on the estimated state tax revenues associated with MII, MBPF and Seed Investment Funds, the 2018 return on TEDCO’s investment totals 23 percent.

Appendix – Economic Impact Methodology

The economic activity generated in a city, county, region or state is greater than the simple total of spending associated with the event or activity being studied. This is because as this money is earned, it is, in turn, spent, earned and re-spent by other businesses and workers in the local economy through successive cycles of spending, earning and spending. However, the spending in each successive cycle is less than in the preceding cycle because a certain portion of spending “leaks” out of the economy in each round of spending. Leakages occur through purchases of goods or services from outside of the region and federal taxation. The IMPLAN multipliers used in this analysis capture the effects of these multiple rounds of spending. This analysis focuses on five measures of economic impact:

- **Output.** The total value of production or sales in all industries;
- **Employment.** The total number of full and part time jobs in all industries;
- **Labor Income.** The wages and salaries, including benefits, and other labor income earned by the workers holding the jobs created;
- **State and Local Government Revenues.** The fiscal benefits accruing to both state and local governments in Maryland as a result of the direct and multiplier impacts associated with TEDCO’s five core programs; and
- **Federal Government Revenues.** The fiscal benefits accruing to the federal government as a result of the direct and multiplier impacts associated with TEDCO’s five core programs.

Four measures of the economic impacts and fiscal impacts of TEDCO’s five core programs are presented in this report:

- **Direct effects.** The change in economic activity being analyzed—in this case portfolio of assisted companies supported by TEDCO’s four core business programs and the stem cell research expenditures associated with the MSCRF. For this analysis, the JFI used the employment data for TEDCO’s portfolio companies, MII and MSCRF research funding, and the IMPLAN model to estimate business activity based on these activities;
- **Indirect effects.** The changes in inter-industry purchases, for example the purchase of research supplies by a university or start-up company;
- **Induced effects.** The changes in spending from households as income and population increase due to changes in production; and
- **Total effects.** The combined total of direct, indirect and induced effects.

The input to the IMPLAN modeling for TEDCO’s four core business programs was the employment of the portfolio of currently active companies that have been supported by these programs. IMPLAN was used to estimate revenues and economic activity based on company employment. Company employment figures and industry were based on data provided by TEDCO, business databases, and internet searches; with missing values estimated by the JFI.