

EXECUTIVE SUMMARY

The Economic and Programmatic Impacts of the Maryland Technology Development Corporation on the Maryland Economy

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Innovation stands as a leading competitive factor driving economic growth for states and regions in today's global, knowledge-based economy. According to the recently released National Research Council Report, *Rising to the Challenge*, the capacity to innovate is fast becoming the most important determinant of a region's economic growth and its ability to compete and prosper in the 21st century global economy.¹ Even back at the turn of the century, the importance of innovation was becoming clear. The former Chairman and CEO of IBM, Samuel Palmisano, explained the challenge broadly to the U.S.: "A key determinant of growth is innovation. Where, how and why innovation happens is changing. If the U.S. wants its fair share of new jobs and economic growth, it must take the steps necessary to continue offering the most fertile, attractive environments for innovation in the world."²

The specific challenge in innovation confronting Maryland is well documented. Maryland is a recognized international leader in research and development—with major research universities and the nation's most advanced complex of federal laboratories. But Maryland has been less successful in terms of the transformation of its research and development strengths into new products, high-growth companies and jobs. According to the Information Technology and Innovation Foundation in its State New Economy Index, Maryland's high ranking as a technology state is "primarily due to high concentrations of knowledge workers, many employed with the federal government or related contractors in the suburbs of Washington, D.C." While this has been good for the Maryland economy, strong reliance on federal spending bodes poorly for the future in an era of federal downsizing and sequestration. Indeed, Maryland lags in the commercialization of technologies based on its large base of university and federal research. The Milken State Science and Technology Report finds that despite Maryland's strength in research and development and high concentration of high technology workers, the state's weakest areas are access to risk capital and entrepreneurial success.

The creation of the Maryland Technology Development Corporation (TEDCO) was the state's response to addressing this challenge of fostering greater innovation for today's global, knowledge-based economy. 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 resulting in the creation and growth of technology-based businesses in all regions of the state.

TEDCO's efforts are generating a strong economic impact. An independent assessment by the Battelle Technology Partnership Practice, the economic development consulting group of the world's largest independent research and development non-profit, further found significant economic impacts from TEDCO's activities:

- *The economic contribution to the Maryland economy of TEDCO's three core research, technology transfer and commercialization programs totaled \$565.9 million in 2013, generating a total of 2,835 jobs.*
- *TEDCO's efforts are also generating high quality jobs with average compensation per job created estimated at \$70,700 compared to statewide average private sector job compensation of \$59,000.*

¹ Charles W. Wessner and Alan Wm. Wolff, Eds. "Rising to the Challenge: U.S. Innovation Policy for the Global Economy". 2012. The National Academies Press, Washington, DC., page xiii

² Samuel J. Palmisano, "How the U.S. Can Keep Its Innovation Edge," *BusinessWeek*, November 17, 2003, page 34

- *Estimated state and local government revenues from the economic activity attributable to TEDCO activities reached \$22.8 million in 2013—a level of revenues that represent 120 percent of TEDCO’s FY2013 appropriation of \$19 million.*
- *Battelle calculated an estimated 23 percent return on investment for 2013 on the State of Maryland’s investment in TEDCO’s core commercialization and technology support programs.*

Most importantly, the impact of these existing TEDCO efforts is projected to grow substantially over the next decade. Battelle estimates that the economic impacts associated with TEDCO’s two core technology transfer and commercialization programs, the Technology Commercialization Fund (TCF) and the Maryland Innovation Initiative (MII), and the Maryland Stem Cell Research Fund (MSCRF) will grow to \$910.3 million in 2018, support a total of 4,527 jobs earning \$320.3 million, and generate estimated state and local government revenues of \$36.6 million, a 68 percent increase over TEDCO’s current economic impact, based on current funding and outcomes levels. These ever-rising impacts from TEDCO’s investments are not surprising, and reflect the fact that TEDCO’s efforts play a key role in early-stage venture development, which will continue to have a positive economic impact for as long as those new ventures continue to operate. This type of activity generates a significant pay-off in sustaining future economic growth.

Beyond its overall economic impact, TEDCO plays a critical role in facilitating, supporting, and enhancing the generation, transfer and commercialization of technologies in Maryland. Altogether, TEDCO’s technology transfer and commercialization programs have resulted in investments in a portfolio of 216 start-up and early-stage companies, which have: attracted an additional \$601 million in downstream investment, thereby matching each state dollar invested by TEDCO with over \$48 in additional, outside investment; supported the creation of 58 new start-up companies; and generated 45 technology licenses for universities and federal laboratories in Maryland.

In advancing these broader functional benefits in supporting Maryland’s economy, Battelle notes the following:

- **TEDCO’s programs can be viewed as an investment in a portfolio of companies and research.** The economic impacts of TEDCO represent more than a simple source of spending. Unlike many other state government efforts, TEDCO’s client firms often leverage the initial state funding with additional private capital, in the case of its core commercialization and technology support programs and with additional federal or private research funding, in the case of the Maryland Stem Cell Research Fund. Furthermore, the portfolio of companies created, and in many cases the stem cell research projects initiated, both remain active in Maryland even after the initial period of state funding, and the state can capture any benefits associated with the growth of its portfolio companies supported and technologies commercialized from the stem cell research funded. Thus, TEDCO programs have the potential to create a portfolio of companies and research activity that both leverage the initial state investment with outside dollars and continue on after the initial period of state funding ends.
- **In its stem cell research program activities, TEDCO’s early-stage funding for university researchers has helped raise Maryland’s national leadership position.** From 2009 to 2012, Maryland raised its level of NIH funding support from \$40.3 million to \$114.4 million, resulting in its significantly improved standing in this highly competitive research field from eighth in the nation to third in the nation for NIH funding of stem cell research.

- **TEDCO has achieved these results in a cost effective manner**, and has achieved both a rate of return and level of job creation comparable to similar state technology-based economic development organizations that enjoy much higher levels of funding.
- **TEDCO’s success demonstrates the value of a public-private partnership effort.** TEDCO operates as a public corporation authorized and funded by the state, with strong engagement and leverage of private sector resources. This unique operating model allows TEDCO to act in an independent, flexible, and nimble manner and contributes to the success of the organization.

Looking forward, Maryland needs to consider how to invest in sustaining and accelerating its economic growth in the years ahead. Continued federal downsizing will challenge Maryland to maintain its past levels of economic growth and prosperity. In the context of slow growth in federal government spending, Maryland will need to diversify its economy and more successfully capitalize on its technology assets.

- **Innovation will be a key to ensuring Maryland’s economic future.** As the 2011 five-year economic development strategic plan put forth by the industry-led Maryland Economic Development Commission, *Charting Maryland’s Economic Path: Discovery, Diversity & Opportunity: A Five Year Strategic Plan*, there needs to be a focused effort to “reinvigorate and bring critical mass to Maryland’s commercialization resources.”³
- **TEDCO is a proven entity that can be further scaled up to address the size of the opportunity for advancing innovation in Maryland.** The creation of the InvestMaryland program, and renewed emphasis of technology transfer, commercialization and job creation at the University System of Maryland, makes TEDCO’s commercialization assistance programs and pipeline of early-stage companies vitally important to supporting overall state economic development goals. At the same time, there is a substantial unmet need for TEDCO’s core programs, with only 29 percent of MSCRF, 37 percent of TCF and 40 percent of MII applications funded over the entire history of each program and its predecessors. This point is even more critical given that TEDCO is often the only source of funding for these seed/early-stage companies, which often become candidates for financing from the Maryland Venture Fund and other InvestMaryland funds, in which the state has made significant investments.

Approach to Measuring TEDCO’s Record of Achievement

TEDCO plays the lead role in Maryland’s efforts to expand commercialization and is involved in all stages of the commercialization process, from supporting research, to facilitating technology transfer, to supporting entrepreneurship, to investing in companies. TEDCO’s mission of supporting technology development and commercialization gives the corporation a clear and vitally important role in Maryland’s economic development efforts and the state’s entrepreneurial ecosystem. In order to describe its important contributions to Maryland, TEDCO contracted with the non-profit Battelle Technology Partnership Practice (TPP) to prepare an analysis of the economic and functional benefits of its operations.

Battelle is the world’s largest non-profit independent R&D institution, and the Battelle TPP is the leading national provider of advanced impact analysis and economic development consulting services for state governments, regional economic development organizations, and major research universities and

³ <http://www.governor.maryland.gov/documents/MEDCreport.pdf>.

institutions. The program staff at the TPP has considerable experience in evaluating the impact of investments in technology-based economic development at the national, state, and regional levels.

The Battelle TPP's approach in analyzing the economic and functional benefits of TEDCO's operations combined a **quantitative analysis** of the economic impacts of TEDCO's three core research and technology transfer and commercialization programs, the *Maryland Stem Cell Research Fund* program, *Technology Commercialization Fund*, and the *Maryland Innovation Initiative*, with a **qualitative assessment** of the role and contribution of TEDCO's overall operations to Maryland's economic development efforts and technology and entrepreneurial ecosystem. The analysis prepared by Battelle for TEDCO consists of the following components:

- Input/output (I/O) analysis to measure the direct, indirect, and induced economic impacts of TEDCO's three core research and technology transfer and commercialization programs on the Maryland economy. This quantitative analysis estimates the economic contribution of these three programs on Maryland employment, labor income, business volume (economic output), and state and local government revenues.
- A qualitative assessment, called the functional impact, of the role and importance of these three programs as well as TEDCO's mentoring and other technology and business support programs to facilitating Maryland's technology and entrepreneurial ecosystem.
- A comparison of the results of this analysis of TEDCO's economic and functional impacts TEDCO to existing evaluation materials for similar state Technology-Based Economic Development (TBED) programs.

Sizable Economic Impacts Found from TEDCO's Core Research and Technology Deployment Programs

TEDCO's three core research and technology transfer and commercialization each have an economic impact on the Maryland economy. Battelle analyzes the economic contribution of technology-based economic development programs in terms of their impact in two core areas:

- **Research and Development (R&D) Expenditures** – TBED organizations support university, business, and other types of research and development expenditures. These expenditures have economic impacts as they are circulated in a regional economy.
- **Business Activities** – TBED organizations provide programs to: 1) foster entrepreneurship and the commercialization of new technologies; and 2) meet the capital needs of entrepreneurial and technology-based businesses. These programs create a “portfolio” of businesses assisted by state or local TBED programs. The operations of these businesses created or assisted and the product sales related to technologies commercialized represent the core economic impacts associated with TBED programs.

The research expenditures and business activity supported by TBED programs have multiplier effects across Maryland's economy. In order to conduct research, universities, federal laboratories, and business R&D facilities purchase goods and services from local suppliers and employ local residents. Similarly, technology-based businesses purchase goods and services from local suppliers and pay salaries to local workers. These purchases and wages are circulated in the regional economy to other businesses and workers who in-turn purchase goods and services from other local companies, who employ and pay wages and salaries to other workers through successive cycles of revenues and purchases. As a result, the

total economic activity supported by TBED programs is greater than their simple R&D expenditures or portfolio company revenues and jobs created. This additional increment of economic activity is called the “multiplier effect.”

As presented in Table ES-1, the economic contribution to the Maryland economy of the research and business activities associated with TEDCO’s three core programs totaled \$565.9 million in FY2013, with a total of 2,835 jobs earning \$200.5 million supported, and estimated state and local government revenues of \$22.8 million. It is important to note that the economic activity associated with TEDCO’s portfolio of companies assisted and research programs generated combined state and local tax revenues that exceeded its state appropriation of \$19 million. The research activities funded by TEDCO and the portfolio of companies assisted by TEDCO directly contributed \$335.4 million in business activity and supported 1,225 jobs. These were augmented with an additional \$111.1 million in economic activity and 719 jobs supported by the *Indirect Effects* or local purchases associated with TEDCO’s operational impacts, and a further \$119.3 million and 891 jobs supported by the *Induced Effects* from the increase in local incomes attributable to these activities.

Table ES-1: Economic Contribution of TEDCO’s Three Core Programs on the Maryland Economy

	Output (\$s)	Labor Income (\$s)	Employment	State/Local Tax Revenue (\$s)	Federal Tax Revenue (\$s)
Direct Effect	\$335,432,555	\$112,816,364	1,225	\$8,677,640	\$20,773,223
Indirect Impacts	\$111,123,719	\$46,324,663	719	\$5,727,694	\$9,044,938
Induced Impacts	\$119,316,619	\$41,321,875	891	\$8,347,312	\$9,036,140
Total Impact	\$565,872,893	\$200,462,902	2,835	\$22,752,646	\$38,854,301
State Impact Multiplier	1.69	1.78	2.31		

Source: Battelle calculations using IMPLAN I/O modeling

The total impacts associated with TEDCO’s three core programs are presented in Table ES-2, with the contribution of each program as follows:

- The portfolio of companies associated with the *Technology Commercialization Fund* has total direct employment of 1,147 jobs and estimated direct annual revenues of \$321.3 million.⁴ The business activities of these TEDCO-supported businesses generate \$539.6 million in economic activity in Maryland, support 2,666 jobs earning \$188.7 million, and have an associated \$21.7 million in estimated state and local government revenues.
- The portfolio of 33 FY2013 company technology commercialization projects associated with the *Maryland Innovation Initiative* had total direct expenditures of \$3.4 million. Because this program was started in the middle of FY2013, no outcomes data in terms of jobs created or product revenues were yet available. As a result, the economic contribution of this program was estimated based on the commercialization-related expenditures of the projects funded. The technology commercialization related expenditures of the Maryland Innovation Initiative are estimated to directly create 19 jobs, and when multiplier effects are included, to generate \$6.4 million in economic activity in Maryland, support 41 jobs earning \$2.8 million, and have an associated \$0.3 million in estimated state and local government revenues.

⁴ As described below, TEDCO provided a database of 216 TCF companies and available outcomes measures. This data was supplemented with Battelle research to estimate total portfolio employment. Because few companies reported revenues, the revenue figures used here were estimated based on reported employment by the IMPLAN model.

- The \$10.7 million in R&D activities associated with the *Maryland Stem Cell Research Fund* are estimated to directly create 59 jobs. When multiplier effects are included, the Maryland Stem Cell Research Fund generates \$19.9 million in economic activity in Maryland, supports 128 jobs earning \$8.9 million, and has an associated \$0.8 million in estimated state and local government revenues;

Table ES-2: Economic Contribution of TEDCO’s Three Core Programs on the Maryland Economy by Program

	Output (\$s)	Labor Income (\$s)	Employment	State/Local Tax Revenue (\$s)	Federal Tax Revenue (\$s)
Technology Commercialization Fund	\$539,622,036	\$188,747,177	2,666	\$21,661,998	\$37,388,155
Maryland Innovation Initiative	\$6,356,488	\$2,836,893	41	\$264,094	\$528,699
Maryland Stem Cell Research Fund	\$19,894,369	\$8,878,832	128	\$826,554	\$937,447
Total Impact	\$565,872,893	\$200,462,902	2,835	\$22,752,646	\$38,854,301

Source: Battelle calculations using IMPLAN I/O modeling

Functional and Strategic Impacts of TEDCO’s Operations

While the economic contributions of TEDCO’s three core programs described above are impressive, that represents only a small part of the total impact on Maryland. TEDCO’s mission is to support economic development in Maryland by facilitating the development, transfer, and deployment of technologies developed by Maryland’s public, private, and government research institutions. Its core mission is to enhance Maryland’s “technology and entrepreneurial development ecosystem.” In many ways, TEDCO’s strategic and programmatic efforts to expand technology development and commercialization are far more important than the economic and job creation impacts described above.

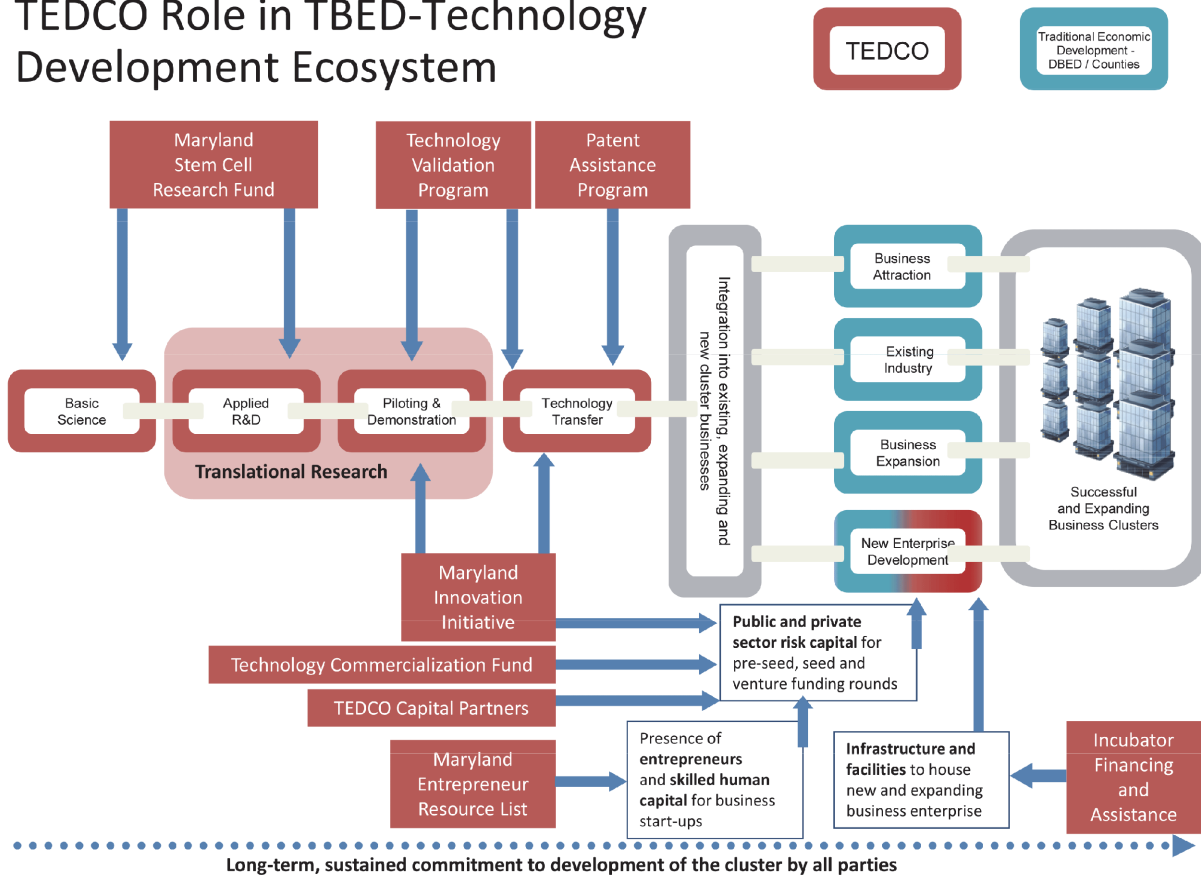
While the strategic and functional impacts of TEDCO on economic and technology development in Maryland are critically important, it is quite difficult to measure and quantify these impacts. Functional impacts, also known to economists as forward linkage impacts, are the critically important effects on the economic ecosystem generated by the technology commercialization programs and services provided by TEDCO. Some aspects such as research volume, companies mentored, and technologies licensed or patented can be quantified. However, assigning an economic value to these programs, projects, or interventions is difficult, if not impossible. As a result, Battelle has focused its efforts on describing the role of and need for the TEDCO programs offered along with any available performance metrics.

Battelle’s analysis of the functional and strategic value of TEDCO is grounded on its national and international work on supporting technology-based economic development at the county, regional, state, and even national level. Achieving success in technology-based economic development is a particularly complex and challenging goal. It requires having in place an interconnected value chain of economic development resources and services to develop and sustain growth across research discoveries and technology commercialization, new enterprise development, growth of existing industry, and attraction of new businesses. If any link in the chain is missing, knowledge-based economic gains in growth-oriented new and existing companies and high-quality job creation are hampered.

In order to analyze the functional and strategic importance of TEDCO in Maryland’s technology and entrepreneurial development ecosystem, Battelle analyzed the role of TEDCO’s programs at each link in the TBED Development Process. An overview of this analysis is presented in Figure ES-1.

Figure ES-1: TEDCO's Role in the Technology-Based Economic Development Process

TEDCO Role in TBED-Technology Development Ecosystem



As described in Figure ES-1, TEDCO provides a full menu of programs designed to support and facilitate the generation, transfer and commercialization of technology in Maryland. Not only does TEDCO generate the economic impacts described above, it provides a full range of services to address the “commercialization gap” identified in both the *Charting Maryland’s Economic Path: Discovery, Diversity & Opportunity: A Five Year Strategic Plan* economic development strategy prepared by the Maryland Economic Development Commission as well as in national reports on technology-based economic development in Maryland as hindering economic development in Maryland. TEDCO’s programs provide needed financial and technical assistance along each of the key links in the TBED Economic Development Value Chain and provide financial and technical support in the critical “Valley of Death” that hinders commercialization. By numerous measures, TEDCO has been successful in these efforts:

- The Maryland Stem Cell Research Program has improved Maryland’s national footprint in this important area of life sciences research and development—and contributed to Maryland moving from eighth in NIH funding for stem cell research to third in the nation.
- The Maryland Innovation Initiative and Technology Validation Program support the early-stage capital needs of entrepreneurial ventures seeking to commercialize the new technologies being discovered in Maryland’s leading universities and federal laboratories. Its predecessor

programs, the University Technology Development Fund (UTDF) and TechStart, assisted 72 technology licenses and supported the creation of 58 new start-up companies.

- The Technology Commercialization Fund has created a portfolio of 216 successful companies that have gone on to receive \$601 million in downstream funding to further support their commercialization efforts, more than ten times the level of state funding for the program.
- The Rural Business Innovation Initiative (RBI2), Maryland Entrepreneurs Resource List (MERL) and Incubator Business Assistance Fund all provide access to technical support and assistance to support entrepreneurial development in Maryland.
- TEDCO Capital Partners assists in addressing the shortage of venture capital investment in the state.

Through these programs and efforts, TEDCO makes a clear and important contribution to improving the technology and entrepreneurial development ecosystem in Maryland. TEDCO's mission and programs are central to the State of Maryland's economic development strategy and consistent with national state technology-based development best practices.

