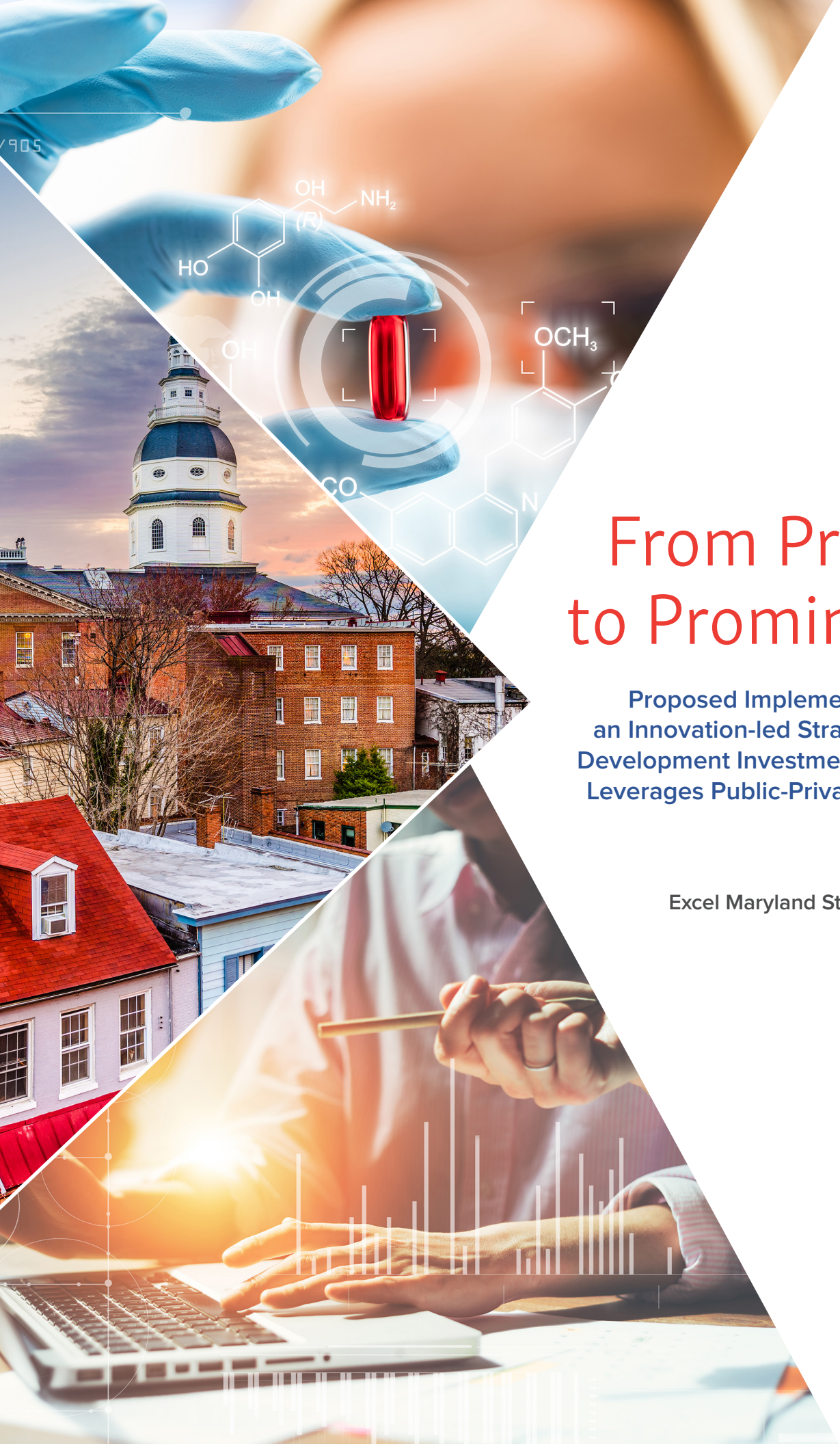

From Promise to Prominence:

Proposed Implementation Plan for an Innovation-led Strategic Economic Development Investment Platform that Leverages Public-Private Partnerships

Prepared by:
Excel Maryland Steering Committee

May 2018

Preamble

Governor Hogan formed the Excel Maryland Steering Committee (Excel Maryland) – composed of innovation leaders from multiple sectors and co-chaired by the President of Johns Hopkins University and the Chancellor of the University System of Maryland – and charged it to design a bold, new statewide economic development initiative to accelerate innovation-driven commercial activity, with a special focus on the state's life sciences and cyber-related industries.

The Phase One report of Excel Maryland, completed in August of 2017, set out the challenges and gaps facing Maryland's innovation ecosystem and called for establishing a new strategic coordinating entity to strengthen Maryland's innovation ecosystem.

This Phase Two report sets out a proposed implementation plan for a new strategic innovation investment platform for advancing multi-sector, signature innovation projects as a catalyst for innovation-led economic development. **Excel Maryland is not recommending a new or additional service delivery economic development organization, but a strategic investment platform that fosters public-private partnerships.** It will unleash significant non-state investment from industry and university partners on a project-by-project basis, leveraging state investments as a catalyst for driving innovation-led development.

With this proposed implementation plan, the work of Excel Maryland is completed.

In the coming months, Excel Maryland recommends that its co-chairs and other Steering Committee members engage the General Assembly and stakeholders involved in innovation to bring forward the proposed strategic public-private investment platform recommended.

EXCEL MARYLAND STEERING COMMITTEE MEMBERS

Robert L. Caret, Chancellor, University System of Maryland (USM) – Co-Chair
Ronald J. Daniels, President, Johns Hopkins University – Co-Chair
Daniel J. Abdun-Nabi, CEO, Emergent BioSolutions
Peter Barris, Managing General Partner, New Enterprise Associates
Tom Geddes, CEO, Plank Industries
Ron Gula, President, Gula Tech Adventures and Co-Founder, Tenable Network Security
Stephanie Hill, Vice President and General Manager, Lockheed Martin
Dr. Bahija Jallal, Executive Vice President, MedImmune and AstraZeneca
Larry Letow, President and CEO, Convergence Technology Consulting
Robert Lord, President, Protenus
Bill Niland, CEO, Harpoon Medical
Wendy Perrow, CEO, AsclepiX, Therapeutics
Paul Silber, Founding Principal, Blu Venture Investors

Ex-Officio Members

Robert C. Brennan, Executive Director, Maryland Economic Development Corp. (MEDCO)
Mary Clapsaddle, Director of Staff Affairs, Johns Hopkins University
Matthew Clark, Chief of Staff to Governor Hogan
George Davis, CEO, Technology Development Corporation (TEDCO)
James Fielder, Secretary of Higher Education, Maryland Higher Education Commission
Mike Gill, Secretary of the Department of Commerce
Patrick Hogan, Vice Chancellor for Government Relations, University System of Maryland (USM)
Sen. Martin G. Madden, Senior Advisor to Governor Hogan
Sen. Robert Neall, Senior Advisor to Governor Hogan
Mathew J. Palmer, Deputy Legislative Officer to Governor Hogan
Steve Pennington, Managing Director, Business and Industry Sector Development, Department of Commerce
James E. Rzepkowski. Assistant Secretary, Department of Labor, Licensing and Regulation
Tom Sadowski, Vice Chancellor for Economic Development, University System of Maryland (USM)
Kelly Schulz, Secretary of the Department of Labor, Licensing and Regulation
Gen. Linda Singh, Adjutant General of Maryland
Chris Shank, Chief Legislative Officer to Governor Hogan
Cassie Shirk, Policy Advisor to Governor Hogan
John Wasilisin, President and Chief Operating Officer, Technology Development Corporation (TEDCO)
Craig Williams, Vice President for Health Innovations and Management Solutions, Johns Hopkins University
John Wobensmith, Secretary of State
Benjamin H. Wu, Deputy Secretary, Department of Commerce
Christy Wyskiel, Senior Advisor to the President, Johns Hopkins University

Consulting assistance from Mitch Horowitz, Principal and Managing Director of TEConomy Partners LLC., a global leader in research, analysis and strategy for innovation-based economic development. For further information, please visit www.teconomypartners.com

TECONOMY PARTNERS LLC

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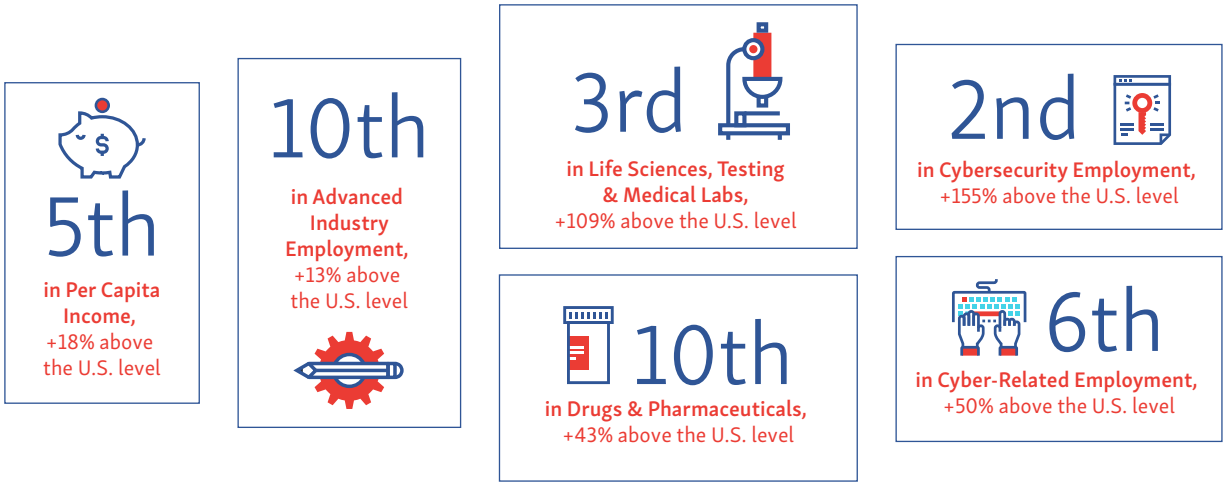
Setting the Context

Maryland's economic prosperity is driven by its innovation-led, advanced industries that are anchored by world-class university and federal research assets and sustained by a significant talent base.

According to The Brookings Institution, advanced industries—characterized by their deep involvement with technology research and development (R&D) and extensive use of STEM (science, technology, engineering, and math) workers— "…. encompass the nation's highest-value economic activity. As such, these industries are the country's best shot at innovative, inclusive, and sustainable growth."[1]

Maryland's strong base of innovation-led, advanced industries is in part a result of the State of Maryland investing in innovation-focused economic development programs, thereby helping to establish itself as a national leader. These innovation-led development programs have strengthened the state's innovation ecosystem across R&D, technology commercialization, new business formation, venture financing and workforce development. The wide-range

Maryland's Standing as a National Leader



Sources: U.S Bureau of Economic Analysis fo per capita income; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages for industry jobs, except Cybersecurity employment from NIST CyberSeek database Note: To measure industry level, compared Maryland to U.S. based on share of industry employment to total private sector industry employment (relative concentration)

1 *For more details see: Brookings Institution, America's Advanced Industries: What They Are, Where They Are, And Why They Matter, Brookings Advanced Industries Project, February 2015*

of development tools available in Maryland sets a foundation for working with individual entrepreneurs, companies and university technologies that in turn spurs new innovations that lead to market opportunities and result in economic growth.

As Maryland looks forward, it cannot become complacent as it competes for national prominence. The bar is rising on advanced industry development, and on the policies and practices needed for success. Maryland must quicken its pace of growth or risk being relegated to second tier status as an innovation leader and putting its economic prosperity at risk.

For Maryland, its two leading advanced industries of life sciences and cyber-related industries continue to generate substantial job growth, with combined growth of just under 20,000 jobs from 2010 to 2016. Each of these two leading advanced industries draw upon a strong base of research and development, new company formation and talent assets found in Maryland.

Still, Maryland's pace of growth in both the life sciences and cyber-related industries is not keeping up with the accelerated pace of growth of other top states, including California and Massachusetts. The risk for Maryland is that capital and talent will be harder to attract and retain as Maryland competes for new areas of innovation in these fields that will fuel future job growth and competitiveness.

Going forward, Maryland must compete more effectively in the race underway for "first mover" advantage in the wide range of transformative life sciences and cyber-related technologies reshaping our economic landscape. Maryland needs a sustained, systematic and strategic approach to lead in key transformative technologies, such as cybersecurity, the Internet of Things, autonomous and robotic technologies and personalized and regenerative medicine.

To ensure the state's future economic competitiveness, Maryland must advance strategic public-private, innovation-led partnerships creating the nexus where industry innovation and academic research competencies can come together to drive local economic development. These transformative, large-scale public-private investment efforts must:

Maryland Continues to Grow its Leading Advanced Industries ...

Maryland Life Sciences jobs

+8,456

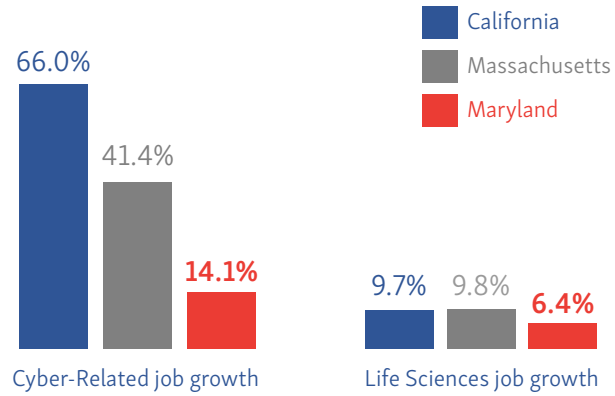
from 2010 to 2016

Maryland Cyber-Related jobs

+10,122

from 2010 to 2016

But Maryland's Growth Not Keeping Pace with Other Top States



Sources: U.S Bureau of Economic Analysis for per capita income; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages for industry jobs

- Leverage targeted growth opportunities
- Bring a consortium of industry collaborators together with research institutions
- Advance placemaking innovation districts to attract the talent, foster collaboration and enable concentration and the ultimate growth of Maryland's innovation ecosystem
- Addressing STEM talent and workforce needs of life sciences and cyber-related industries through multi-institutional, industry-led approaches
- Unlocking private investment for innovation-related projects

Not only are top-tier competitors making these large-scale investments, such as Mission Bay in San Francisco and Kendall Square in Massachusetts, but emerging competitors are making such investments as well, such as Indianapolis with the recent launching of the 16 Tech. Maryland must also invest to ensure it does not continue to lose market share.

To sustain transformative investments, a wide number of competitor states have advanced their own strategic innovation investment platforms using state funds to leverage public-private partnerships with industry, universities and other stakeholders. Examples are set out in Figure 1 below.

Figure 1: Examples of Other State Strategic Innovation Investment Fund Platforms for Public-Private Partnerships with Details on Average Annual Funding Levels and Primary Uses of Funds

Illustrative Peer Organization	Average Annual Funding Levels for Strategic Innovation Project & Center Funding	Primary Uses
Georgia Research Alliance	$26 million per year ($644 million over first 25 years)	Eminent scholar endowments, start-up packages and commercialization funding
Ohio Third Frontier University-Industry Collaborations	$31 million per year ($440 million over 14 years) in R&D centers	Wide range of university-industry research collaborations and centers, including Wright Centers, Wright Projects Program, Industrial R&D Centers and Innovation Platform Program
Mass Life Sciences Center Capital Projects	$51 million per year or $457 million from FY 2009-FY 2017 in capital and academic/industry research projects	Multi-user university-based lab facilities, post-secondary education facilities, regional accelerators/ incubators and academic/industry research partnerships)
Oregon Inc.	$10 million per year ($19.7 million over FY 2015-2017 biennium)	Three industry-led collaborative research and commercialization centers in key technology areas (nanoelectronics, life sciences and clean tech) + industry consortiums in key areas like unmanned aerial systems
Mass Tech Collaborative Industry-University Centers	$8 million per year ($24 million awarded from FY 2014-2016)	Collaborative research grants for industry/ university research centers and commercialization

Source: Prepared by TEConomy based on website information from state programs and organizations

Why Strategic Innovation Investments Leveraging Public-Private Partnerships Matter

Fundamental to the recommendations by Excel Maryland is the notion of building upon competitive strengths through innovation clusters with an increased focus on achieving a density of activity and quality of placemaking to compete for talent and industry investment which has many choices in where to locate. As the National Research Council explains in Best Practices in State and Regional Innovation Initiatives Competing in the 21st Century:

> *"Innovation clusters – localized groups of companies developing creative products and services within an active web of collaboration that includes specialized suppliers and service providers, universities, and research institutes and organizations – are now widely associated with higher levels of economic growth and competitiveness."* [2]

The pursuit of competitive advantage through industry clusters has become quite challenging. As the Brookings Institution explains: "Strong challenges from other nations, inconsistent engineering and workforce training systems, and negative trade balances in some advanced industries mean that U.S. dominance of the global sector is contested … As a result, leading states and metropolitan areas are acting on their own—in collaboration with their most strategic industries—to support innovation, invest in local industry clusters, drive trade, and build the STEM skills base for the next round of advanced industry growth."[3]

What differentiates those states and regions that are succeeding from those that are lagging is a strong focus on the breadth and density of development, the ability to do big things together, a focus on placemaking and the invention of new models of growth, governance and finance. The key characteristics found by Antoine van Agtmael and Fred Bakker in their comprehensive assessment of successful regions in innovation-led development resonate strongly throughout the recommendations of Excel Maryland:[4]

- Taking on complex, multidisciplinary and expensive challenges that could not be handled by any single player alone.
- Being driven by a connector, an individual or group with vision, relationships, and energy that is largely responsible for establishing and building the ecosystem.
- Operating in a collaborative ecosystem of contributors, with research universities at their center and typically composed of start-ups, established companies with a thriving research function, local government authorities and community colleges or similar vocational institutions.
- Containing physical centers, such as incubators and start-up spaces.
- Fostering an environment that acts as a magnet for talent. The area offers not only an existing talent pool in universities, research institutes and start-ups but also non-work attractions and benefits, such as affordable housing, a variety of cafes and restaurants, good school and recreational activities.
- Have capital available. There is sufficient money available for investment in start-ups and spin-offs, as well as for facilities and incubators.
- Have an understanding and acknowledgment of threat.

With these best practice lessons in mind, the path forward to accelerate the trajectory of Maryland's economic development is to pursue investments in public-private partnerships that can make a transformative difference in our leading innovation-led sectors.

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2 *Wessner, Editor, Best Practices in State and Regional Practices in State and Regional Innovation Initiatives Competing in the 21st Century, Board on Science, Technology and Economic Policy, National Research Council, 2013, pages 8-9*

3 *Muro, Fikri and Andes, "Powering Advanced Industries, State by State, Brookings Institution, 2014, page 5 – report features efforts of Colorado and Tennessee to catalyze growth and competitiveness of targeted advanced industries*

4 *Antoine van Agtmael and Fred Bakker, The Smartest Places on Earth: Why Rustbelts are the Emerging Hotspots of Global Innovation, Public Affairs, 2016, page 26.*

Vision, Approach and Strategic Goals Recommended by Excel Maryland

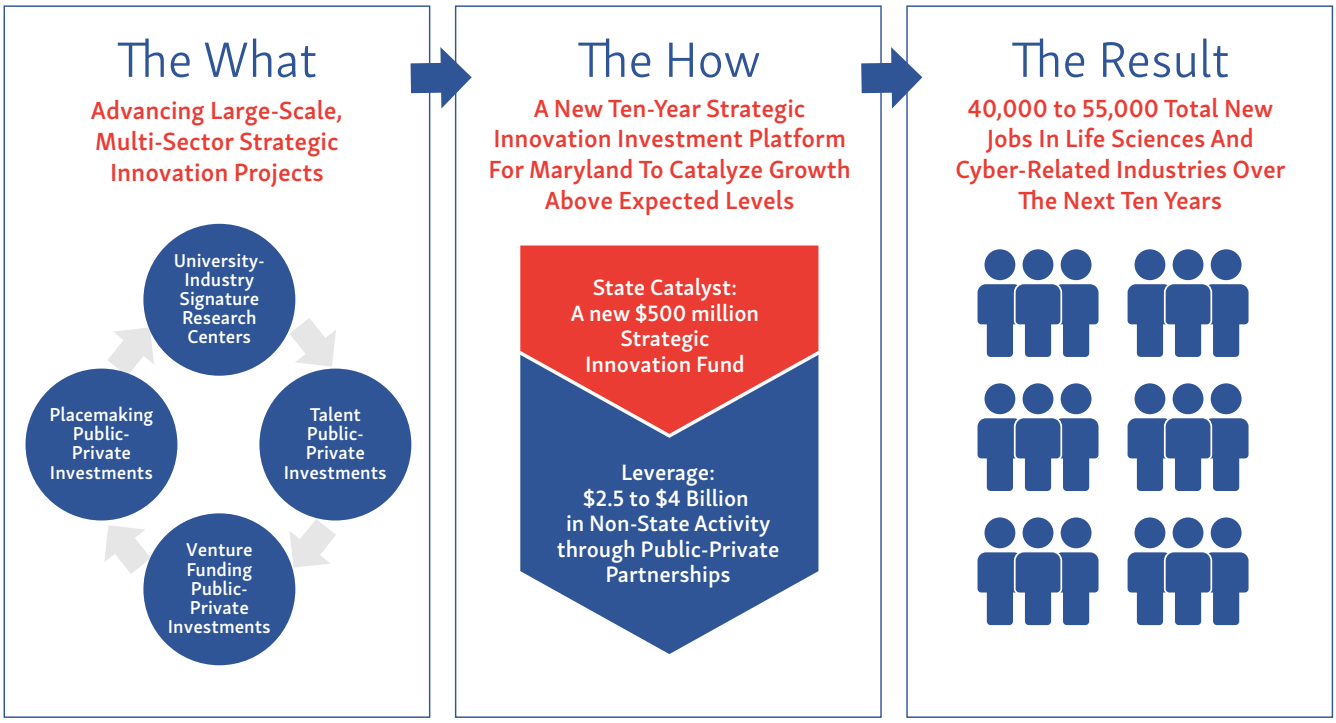
Excel Maryland recommends a much-needed, forward-looking, public-private platform for developing strategic initiatives and engaging multi-sector partners across industry, academia and the public sector.

On a project-by-project basis, non-state investments from industry, university and other sources would be leveraged in a multitude of ways from:

- Direct co-investment in projects
- Follow-on funding generated from project activities, such as investments in new businesses started
- Product sales and other economic activity generated through the projects

Going forward, this initiative proposes a structured means of bringing together Maryland's major research universities with industry and state entities to make strategic investments that ensure Maryland keeps pace with other innovation-led markets.

Reaching for National Prominence: A Strategic Innovation Investment Platform to Leverage Public-Private Partnerships that Accelerate Maryland's Growth in Advanced Industries



The long-term vision that Excel Maryland recommends is to:

Unleash Maryland's innovation potential to reach national/global pre-eminence in areas of advanced industry development, with an initial focus on life sciences, cybersecurity and advanced computing and data sciences, by utilizing strategically focused public-private partnerships to best leverage Maryland's many assets and advance economic development.

The specific objectives recommended by Excel Maryland for the new strategic innovation investment platform are to:

- **Be governed by private and public thought leaders and directly accountable to the Governor and General Assembly**
- **Facilitate high-touch customer service** for advanced industry outreach and engagement to identify strategic opportunities and guidance
- **Manage strategic investments in major new projects and initiatives involving multi-sector collaborations** targeted to advancing large-scale innovation development opportunities
- **Invest in placemaking to attract talent, capital, innovative companies and major industry leaders**
- **Bring together multiple sources of funding from across public, private, academic, and other resources.**

On a project-by-project basis, state investments on large scale, multi-sector strategic innovation projects will generate significant leverage of non-state investments from industry, university and other sources. Typically, projects will have at least a $2 non-state to $1 state (2:1) leverage in co-investments or committed follow-on funding from non-state sources in its first two years. Over time, it is expected that the broad leverage reached across public-private partnership projects will be substantially higher, reaching between 5:1 and 8:1 by Year Ten through direct co-investments, follow-on funding and measurable direct economic activity generated.

Georgia Research Alliance reports a 6:1 leverage since 1990 on $600 million of state funding, while Ohio's Third Frontier recorded an 8:1 leverage on $763 million spend in its first decade. For the first time ever, the initiative brings together Maryland's major research universities with industry and state entities to ensure Maryland can keep pace with its competition for innovation-led development.

Recognizing that the scale of current efforts is insufficient to pursue large-scale development opportunities, Excel Maryland recommendations will provide strategic development and investment capacity to advance transformative, large-scale projects involving its multi-sector partners. These investments will also complement ongoing state innovation and workforce development efforts.

Excel Maryland is not recommending a new or additional service delivery economic development organization, but a strategy and investment platform that fosters public-private partnerships. The ongoing innovation and workforce program functions and responsibilities across organizations such as Commerce,

DLLR, TEDCO and MEDCO need to continue, with increased coordination and collaboration as an integral dimension in achieving the strategic goals for innovation-led development set out by Excel Maryland.

The intent of Excel Maryland in its recommendations is not to pick individual corporate winners and losers. Instead, it calls for strategic thinking about where the state has opportunities for economic growth and then to seek out collaborations across industry, universities and state and local economic development that fosters broad industry cluster development and makes effective use of limited state resources to drive measurable results with significant leverage of non-state resources.

The strategic goals set out by Excel Maryland, based on a realistic assessment of Maryland's competitive position versus other leading states, are to:

Be a National Leader in Targeted Advanced Industry Development[5]

Specific Ten-Year Goal: Add 40,000 to 55,000 jobs between bio-health and cyber-related industries to be among top leaders in industry specialization in both sectors.

Be a National Leader in High Growth Companies

Specific Ten-Year Goal: Double the number of IPOs and number of Inc. 5000 fastest growing privately held companies in bio-health and cyber-related industries to reach 5 percent or greater share of the national total.

Be a National Leader in Innovation

Specific Ten-Year Goal: Double the level of venture capital investment in bio-health and cyber-related emerging ventures to reach top 5 among major states in each sector.

Be a National Leader in Talent

Specific Ten-Year Goal: Lead the nation in talent employed in specific skilled occupations relating to bio-health and cyber-related fields.

5 *The 40,000 new job estimate is based on the sum of the expected level of job growth for cyber-related and bio-health jobs using the most current annual industry growth projections from the Maryland Office of Workforce Information and Performance plus additional jobs generated from the $500 million investment using the IMPLAN input-output economic model reflecting current world outcomes. The 55,000 new job estimate reflects additional growth based on Excel Maryland's recommendations helping to improve the state's overall innovation ecosystem beyond current world outcomes and represents an aspiration goal where Maryland's competitive position improves relative to other states.*

Implementation Plan: Proposed Governance, Program Activities, Operations and Funding Sources

Excel Maryland recommends the formation of **an independent, but highly accountable, strategic investment platform for innovation-led development in Maryland.** The proposed elements of how Excel Maryland will be implemented include:

Governance and Oversight:

The new strategic development and project investment platform recommended by Excel Maryland will be governed by an independent, tripartite board of public and private sector leaders from industry, university, and state government, representing a mix of ex-officio members from research universities and state government entities as well as appointed members from industry.

- Industry members – Selection by the Governor based on meeting key criteria, such as funding participation in support of Excel Maryland and representation of innovation sectors

- Research University members – leaders of JHU and University System of Maryland would be ex officio voting members

- State Government members – such as leaders of Commerce, TEDCO, DLLR and Budget and Management — would be ex officio voting members

- The mix of Board representation between private and public sectors would depend upon sources of funding. If largely public funded, then more accountability through a higher share of public representation is warranted.

Options would include having TEDCO establish a new public-funded strategic innovation investment fund as a related, but independently governed non-profit public corporation to serve as this platform, or pursuing separate legislative authority establishing this new public-funded strategic innovation investment fund.[6] Whichever option is pursued, the Governor and General Assembly will need to guide and act on establishing and funding this new initiative for innovation-led development.

Excel Maryland recommends that this strategic innovation investment platform be a highly accountable organization, reporting directly to the Governor and General Assembly. It will submit an annual budget as well as financial and performance reports on its activities.

6 *Note: In TEDCO's statute under its powers of corporation section, it may "create, own, control, or be a member of a corporation, limited liability company, partnership, or other entity, whether operated for profit or not for profit."*

These will include reporting on:

- Organizational performance, including programmatic activities and sources/uses of funding

- Individual project performance, including specific milestones achieved, leveraging of additional funding sources, and specific outcome measures such as increased technology transfer, new product developments and job creation/ retention.

- Statewide achievement of broad strategic goals for innovation-led development from across the entire innovation community.

Program Activities:

Excel Maryland recommends that three significant and inter-related programmatic functions be carried out through the new strategic innovation investment platform:

- **Facilitating strategic planning and guidance** by convening leaders from industry and anchor research institutions, as well as other key innovation stakeholders, to identify policies and investments needed to advance Maryland's innovation around targeted growth opportunities and placemaking efforts.

- **Managing a strategic innovation fund** for investments in multi-sector large-scale, transformative projects, such as university-industry signature research centers, placemaking projects, targeted new venture funds and STEM talent and workforce projects. The strategic innovation fund would tap state funding, and on a project-by-project basis leverage additional funding from industry, university and other sources.

- **Coordinating economic development service delivery** to break down silos and ensure high-quality customer service, but not own all the services being delivered.

Operational Capabilities:

The operational needs of the strategic innovation investment platform will be focused around having the staffing capabilities able to conduct strategic assessments to identify innovation needs and opportunities; engage and facilitate leaders from across industry, research universities and the public sector to create public-private partnerships; and assess the feasibility and monitor the performance of large-scale, transformative innovation-related projects involving multi-sector participants. It will be led by a senior level, highly experienced strategic planning professional with demonstrated expertise in innovation-led development and complemented by a small strategic planning and project financing staff.

Sources and Uses of Funding:

The direct operations of the strategic innovation investment platform will involve costs for staffing, offices, databases and data analysis tools and special studies involving outside contractors. A direct appropriation for operations from the state budget or through participating state organizations is likely to be the primary source of operational funding, especially in the initial years. The strategic innovation investment platform should also seek operational funding from universities and industry members helping to govern Excel Maryland to help ensure long-term sustainability. To the greatest extent possible, the operational needs of the strategic innovation investment platform will make use of shared office space and staff resources, as appropriate, with existing state entities/organizations through inter-agency agreements.

The funding of the strategic innovation investments will require a significant state commitment of general and capital appropriations. A new strategic innovation

fund of $500 million over a ten-year period is proposed based on public funding provided to peer organizations in other states addressing strategic innovation needs (see chart on page 3 for examples of level of funding provided by other states for their strategic innovation investment platforms).

The value of the state's funding for the strategic innovation investment platform is that it will unlock significant industry, university, federal and philanthropic funding for public-private partnerships across a range of transformative, large-scale projects, such as:

- Large-scale placemaking projects with public funding helping to engage private developers, universities and philanthropic sources as done in Mission Bay, Kendall Square, Indianapolis, St. Louis and many other communities across the U.S.

- Major industry-university research and commercialization centers in which public funding leverages direct industry participation and financial support and are then positioned to attract significant follow-on philanthropic and federal funding

- Targeted venture funding initiatives that use state matching funds to attract new lead venture capital firms and major corporate partners to invest in the formation and growth of high-potential new start-up companies in Maryland

- Statewide talent development initiatives that tackle critical skill shortage areas by advancing partnerships between universities, major corporations, philanthropic organizations supported by federal funding

Please see Appendix A for illustrative best practice examples from other states of similar types of projects as suggested for the new strategic innovation investment platform.

Excel Maryland recommends that the proposed strategic innovation investment platform also be encouraged to generate returns from its investments. While these returns are not expected to be sufficient to sustain all future state investment funding needs, this approach would enable successful projects to support future projects. The returns realized from the state funding of the Maryland Bioprocessing Center serves as a good example, where lease payments generated from the private operator helped fund MdBIO in the 1990s. TEDCO also is generating returns from many of its programs that are reinvested to support ongoing program efforts.

The organizational approach for the proposed new strategic innovation investment platform recommended by Excel Maryland is depicted on the following page.

Figure 2: Depiction of Organizational Approach for Proposed Strategic Innovation Investment Platform Recommended by Excel Maryland

Next Steps

The conceptualization, planning and proposed implementation of the new strategic innovation investment platform recommended by Excel Maryland has involved substantial outreach and engagement with innovation stakeholders across industry, research universities, the venture community, and public organizations.

This has already yielded important strategic guidance that has led to new initiatives, including the proposed legislative initiatives such as the “Buy Maryland Cyber” tax credit, placemaking initiatives around colleges, universities and federal facilities, internship programs for small technology-based businesses and the Maryland Center for Cell Therapy Manufacturing in Baltimore City.

The implementation process moving forward will focus on establishing the recommended strategic innovation investment platform. It will include two important pre-launch steps. One step will be an active outreach and engagement process with the broader economic development leadership across Maryland, including the General Assembly and industry stakeholders, on the imperative of these recommendations and set the stage for legislative action in 2019. The second step, led by TEDCO, will focus on the development of an initial round of proposed multi-sector, public-private partnership projects for investment to begin the process of accelerating Maryland’s growth trajectory.

Appendix A: Best Practice Examples across Potential Uses of Proposed Strategic Innovation Fund

Large-scale innovation-led placemaking projects with public funding helping to engage private developers, universities and philanthropic sources

$10 million investment by Massachusetts Life Sciences Center in LabCentral at Kendall Square in Cambridge

- Pioneered a new approach to concierge services, plug-and-play lab space for high-growth-potential biotech companies that can benefit from partnerships with large biopharma companies
- 51 companies served, 24 graduated
- Graduates located largely in Cambridge and nearby Boston
- $1.1 billion in capital raised by tenants or alumni, including $351 million in Series A
- 154 company-sponsor relationships
- 717 jobs created in participating companies
- 261 patents filed, 45 granted

$136 million investment by Pennsylvania Keystone Innovation Zone Program

- Launched in 2004 to address the lack of entrepreneurial activity and knowledge economy growth around Pennsylvania's higher education institutions
- 29 Keystone Innovation Zones established in designated areas around Pennsylvania's higher education institutions in both rural and urban regions that are partnered with 91 higher education institutions ranging from research universities to community colleges
- $136 million in state spending through transferable tax credits targeting emerging companies under eight years old in high priority industries designated by each KIZ
- $4 billion leveraged in follow-on investments and product sales
- 9,482 jobs created with 2,960 recent graduates hired
- 1,438 new product innovations generated by assisted companies involving $879 million in R&D expenditures with 740 patents and 82 software copyrights

Major industry-university research and commercialization centers in which public funding leverages direct industry participation and financial support and are then positioned to attract significant follow-on philanthropic and federal funding

$60 million investment by Ohio Third Frontier in Global Cardiovascular Innovation Center

- A consortium of clinical, academic and economic development institutions throughout Ohio, established and led by the Cleveland Clinic, to be an international leader in developing, incubating and commercializing cardiovascular technology
- Founded in 2007 with $60 m of OTF funding
- More than $1 billion leveraged from follow-on funding and exits
- 1,000+ new jobs created
- 37 GCIC supported companies advancing innovation and five ongoing incubator graduates
- 17 companies attracted to Ohio

$30+ million investment by Oregon in the Oregon Nanoscience & Microelectronics Institute

- Advanced an industry-led non-profit, started in 2006, that partners with universities across the state to advance nanotechnology capabilities and commercialization
- 37 start-up companies still in business
- $9.7 million in gap funding from Institute leveraged $312 million in private investment
- Annual nanoscience and microtechnology research grew from $9m in FY 2004 to consistently above $30 m annually, with total funding of $361 m through 2015
- Industry support of $36 m in equipment, facilities and services

Targeted venture funding initiatives that use state matching funds to attract new lead venture capital firms and major corporate partners to invest in the formation and growth of high-potential new start-up companies

$7.5 million State Investment for Georgia Research Alliance to GRA Venture Fund

- Serves as the "lead" early-stage investor in selected university startups participating in GRA's venture development program, GRA Ventures, that identifies promising technologies, conducts due diligence, supports proof-of-concept and helps launch new companies
- $7.5 million "evergreen" investment from the State of Georgia in 2009
- Directly been matched by $37 million of private investment in GRA Venture Fund from individuals, universities, foundations and other organizations
- A dozen companies now in GRA Venture Fund portfolio
- $460 million leverage in outside venture capital co-invested with GRA Venture Fund

$88 million Ohio Third Frontier Entrepreneurial Services Provider and Regional Pre-Seed/Seed Funds

- Regionally based network to assist entrepreneurs identify technologies, accelerate their venture development and access capital, combined with regionally-based professionally managed capital
- State investment of $88 million in Pre-Seed/Seed Funds directly matched 1:1 by private sector investors
- 330 companies funded, approximately 35% of the 1,600+ companies served by ESPs
- 3,074 new jobs created
- $3.2 billion in leverage generated from follow-on equity and product revenue

Talent development initiatives that tackle critical skill shortage areas by advancing partnerships between universities, major corporations, philanthropic organizations

$3 million Investment by Massachusetts Life Sciences Center in Worcester Polytechnic Institute's Biomanufacturing Education and Training Center

- A fully functional pilot-scale biomanufacturing plant that mirrors real-world facilities for providing extensive hands-on customized training to the life sciences community
- Assistance to outfit physical space and purchase specialized equipment
- Offers nine 1-5 day programs for life science manufacturing technicians, operators and engineers to keep abreast of latest technologies as well as customized training courses created for companies
- Offers graduate-level education programs, including a Master's in Biotechnology
- Leverages significant industry donations of latest equipment
- 1,300 industry professionals and students trained in last five years

$1 million Washington State investment in university-wide data science education through University of Washington's eScience Institute

- Engages students across disciplines in developing and applying advanced computational methods and tools to real-world problems in data-intensive discovery
- Started in 2008 with State funding of $1 million to transform universities' capabilities in data science with additional annual funding provided in early years
- Adopted a "specialization within existing majors" to data science education at both the undergraduate and graduate levels
- Offers a new Master of Science and a Professional Certificate in Data Science
- Wide range of student engagements including ongoing tutorials, bootcamps, hackathons, and other short education events, plus a summer program involving Data Science for Social Good
- Leverages more than $6 million annually from significant philanthropic and federal funding including three major foundation awards and a federal funded integrative graduate education and research traineeship (IGERT) data science PhD program
- Industry sponsorship, including from Microsoft Research