

The Economic Imperative for Changing the Trajectory of Virginia's Innovation Economy:

*IAT's Guidance for Implementation Planning:
Key Concepts and Approach*

Virginia Research Investment Committee Meeting

October 9, 2018

Today's Discussion Topics

- Recap of VRIC and its Strategic and Implementation Planning Process Leading to Today's Meeting
- Economic Imperative for Changing Trajectory of Virginia's Innovation Economy
- IAT's Guidance on Implementation Plan
- Wrap-Up and Next Steps

Recap: Legislative Objectives for the Virginia Research Investment Committee

The Virginia Research Investment Committee (VRIC) was formed in 2016 to:

- Foster innovative and collaborative research, development, and commercialization efforts in the Commonwealth in projects and programs with a high potential for economic development and job creation opportunities
- Position the Commonwealth as a national leader in science-based and technology-based research, development, and commercialization
- Attract and effectively recruit and retain eminent researchers to enhance research superiority at public institutions of higher education
- Encourage cooperation and collaboration among public institutions of higher education, and with the private sector, in areas and with activities that foster economic development and job creation in the Commonwealth

The Strategic & Implementation Process

January 2018: VRIC Research Asset Assessment Report Completed Setting Out Strategic Directions

March 2018: A small SME Implementation Advisory Team formed by VRIC began to consider how to prioritize and integrate the recommended Strategic Directions

VRIC Briefings on IAT Work Efforts and Deliberations:

- April 9, 2018
- June 12, 2018

Today's VRIC Meeting – Seek approval of “concepts” from Final IAT Guidance

Recap Implementation Advisory Team Composition and Engagement

Comprised of Key Stakeholders With Expertise and On-the-Ground Knowledge:

14 members, chaired by John (Dubby) Wynne, GO Virginia representative, and co-chaired by Peter Blake, VRIC representative

Other members: :

- University senior research officers

- Deb Crawford, VPR, GMU
- Theresa Mayer, VPR, VT
- Ram Ramasubramanian, VPR, UVA

- Leaders of regional entrepreneurial development initiatives

- Monique Sury Adams, Executive Director, 757 Angels, Hampton Roads
- Ross Baird, President, Village Capital Group, NOVA
- Mary Lou Bourne, Executive Director, Office of Technology Innovation and Economic Development, JMU
- Mark Gignac, Executive Director, Institute for Advanced Learning and Research, Danville
- Todd Nuckols, Executive Director, Lighthouse Labs, Richmond

- Advanced industry representatives

- Jeff Gallagher, CEO, Virginia BIO
- Victor Iannello, CEO, Radiant Physics, serial entrepreneur
- Laura Naramore, Executive Director, Corporate Development, MITRE
- Todd Stottlemeyer, Former CEO, Inova Center for Personalized Health, serial entrepreneur

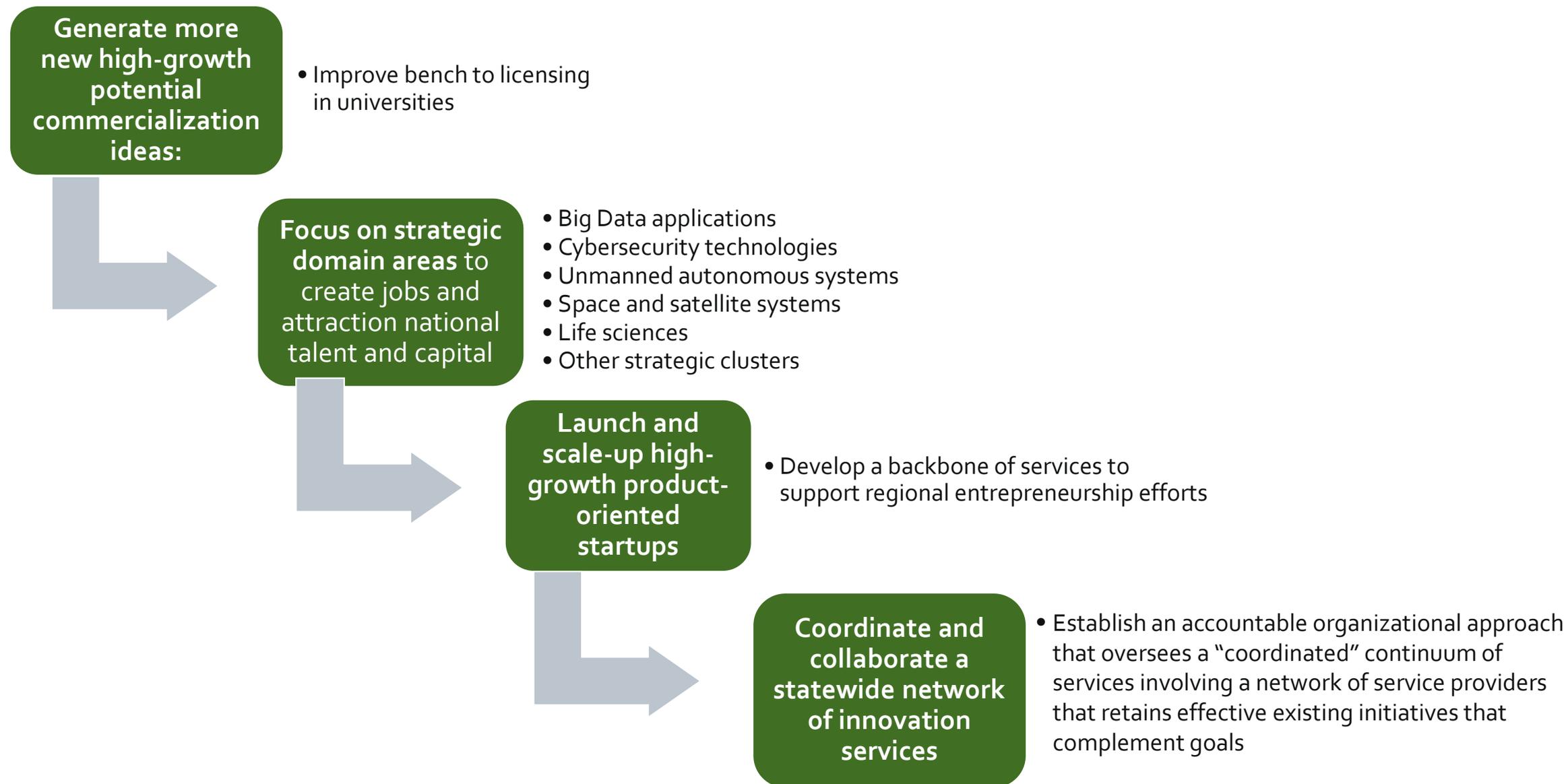
Active Engagement: March to September

Seven full Implementation Advisory Team meetings

Formed two working subgroups:

- Advancing industry-led translational research centers in strategic growth opportunity areas
 - Three working subgroup meetings
 - Four industry roundtable meetings
 - Seven industry organization discussions and some individual member company interviews
- Strengthening the pathway from research invention to new firm formation via regional innovation ecosystems
 - Four working subgroup meetings
 - Five regional assessments of ecosystems involving major research universities

Final IAT Guidance: Four Implementation Activities to Change the Trajectory of Virginia's Innovation Economy

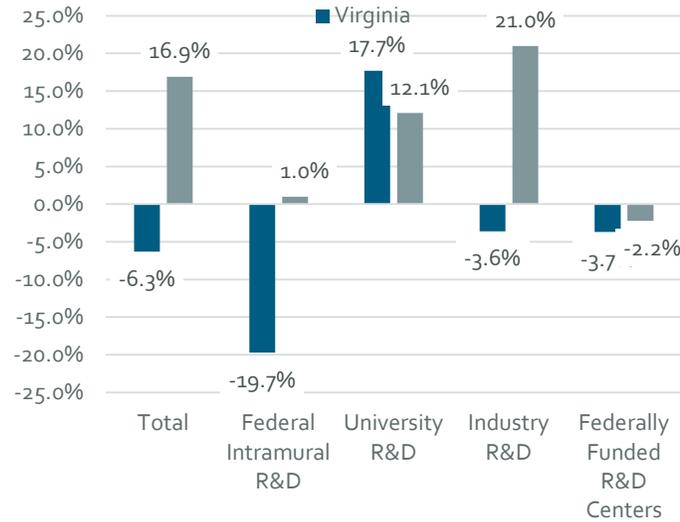


The Economic Imperative:

“Virginia is Falling Behind”

How Our Innovation Growth Trajectory is Off Course

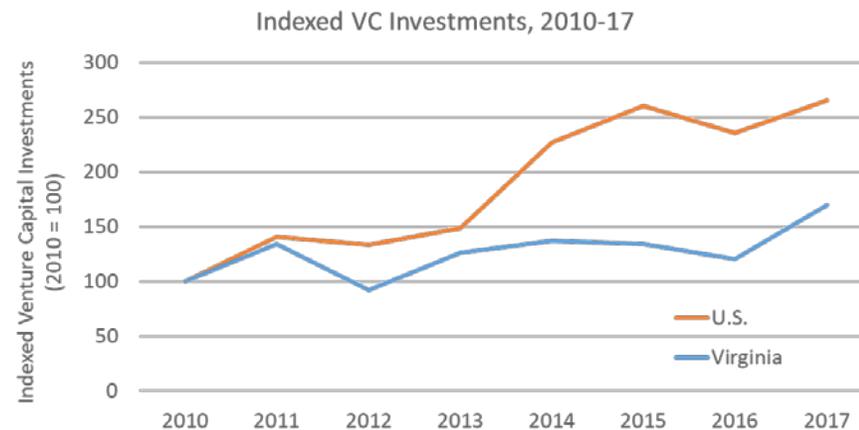
- Declining Total Research Funding, 2010-2015:**



Between 2010 – 2015, Industrial R&D fell by 3.6% while rising nationally by 21%, ranking Virginia 40th

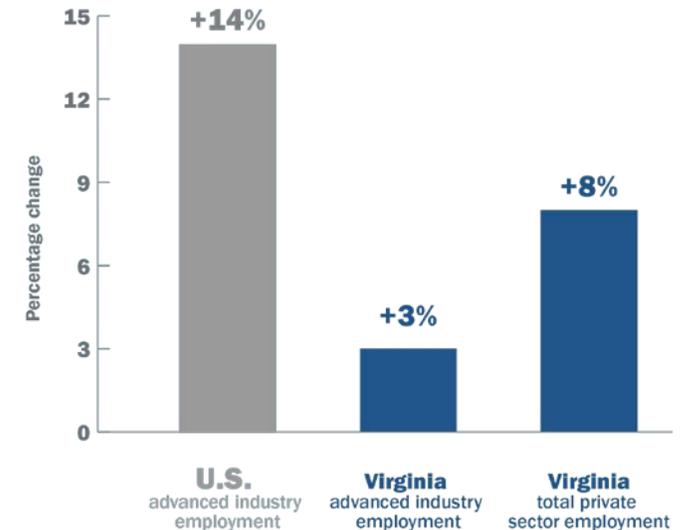
Plus, Virginia’s patent levels stand 25% lower than the nation when normalized for the size of the economy

- Venture Capital Growth Off Pace, 2010-2017**



Virginia achieving only 1/3 the national growth rate

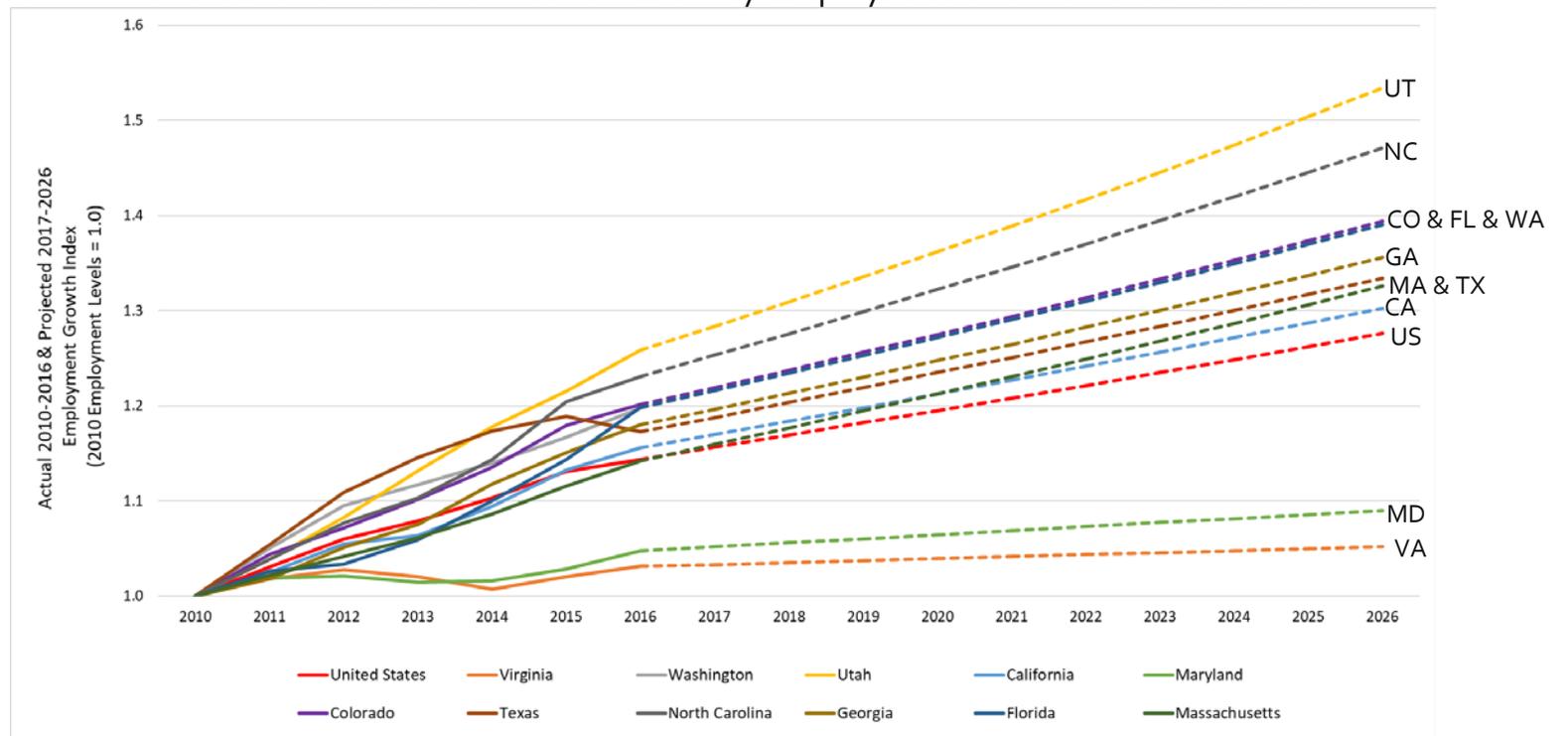
- Lagging Growth in Advanced Industry Jobs from 2010-2016:**



If Current Trends Continue, Virginia will Fall Further Behind Other Leading Innovation States

- Virginia's slower growth compared to the nation in advanced industries over the 2010-2016 period translated into a missed opportunity of an additional 40,000 jobs paying an average of \$100,000.
- If Virginia continues to grow at a rate 1/5th the national average, it can expect to fall even further behind other leading innovation states, as shown in the graphic below:

Projection of Advanced Industry Growth if Trends from 2010-2016 Continued through 2026
Based on U.S. Bureau of Labor Statistics Industry Employment Forecast for 2016-2026



Why Virginia is Falling Behind

- *Virginia needs to continue to upgrade its research commercialization efforts that lead to high-growth potential innovations for new business startups*
 - *Relative to other states, Virginia has a weak culture of innovation and insufficient support for entrepreneurial ecosystems*
 - *Virginia does not dedicate sufficient, focused resources to the formation and scale-up of high-growth startups and industry clusters that are essential to retaining and attracting talent*
 - *Virginia can address these deficiencies through focused state initiatives*
-
- Today, Virginia's reality falls well short of what is needed:



Lagging conversion of research into new businesses



Limited ability to generate startups and to retain companies that are scaling up to serve commercial markets



Inability to create dense industry clusters where Virginia has a competitive advantage



Losing top talent to other states

Key Facts on Why Virginia is Falling Behind

Key Facts:

- Undersized in university research – while ranking 14th in nation, still \$1 billion lower than the 10th ranked state
- 77% of university licenses executed in 2018 were to out-of-state companies
- Startup activity below national average for comparable institutions



Lagging conversion of research commercialization into new business formation

Key Facts:

- 22nd out of 25 largest states in startup activity
- Over 100 venture backed firms left Virginia over the past 5 years. The ones that left created 41 jobs per firm compared to 23 jobs per firm of the venture-backed ones that stayed
- 14,000 highly educated workers outmigrated from 2012-2017



Limited ability to generate startups and to retain companies that are scaling up to serve commercial markets

Key Facts:

- Out of 13 specialized Advanced Industries in Virginia, all but three grew slower than the nation
- Industry R&D from own-sources stands 1/3rd lower than U.S. level and growing at half the rate of U.S. from 2010-2015
- Few existing business groups or technology efforts focused on commercialization or new startups



Falling short in creating the density in industry innovation clusters that drive economic and high-wage growth

Jerry Nemorin – a UVA Darden graduate – founded Lendstreet, a financial services technology that helps middle-and-lower-class families refinance debts, at UVA's i.Lab incubator. He wanted to stay in Charlottesville, but couldn't raise sufficient funding in Virginia. He raised \$500,000 in California, moved there, and has since raised over \$100 million to refinance the debts of thousands of families.



Every loss of a company or an individual has a story like Jerry Nemorin.

Key IAT Guidance: *Build University Capacity to Improve Commercialization Pathway*

Key Function: *The Bench to Licensing Continuum for Research Commercialization*

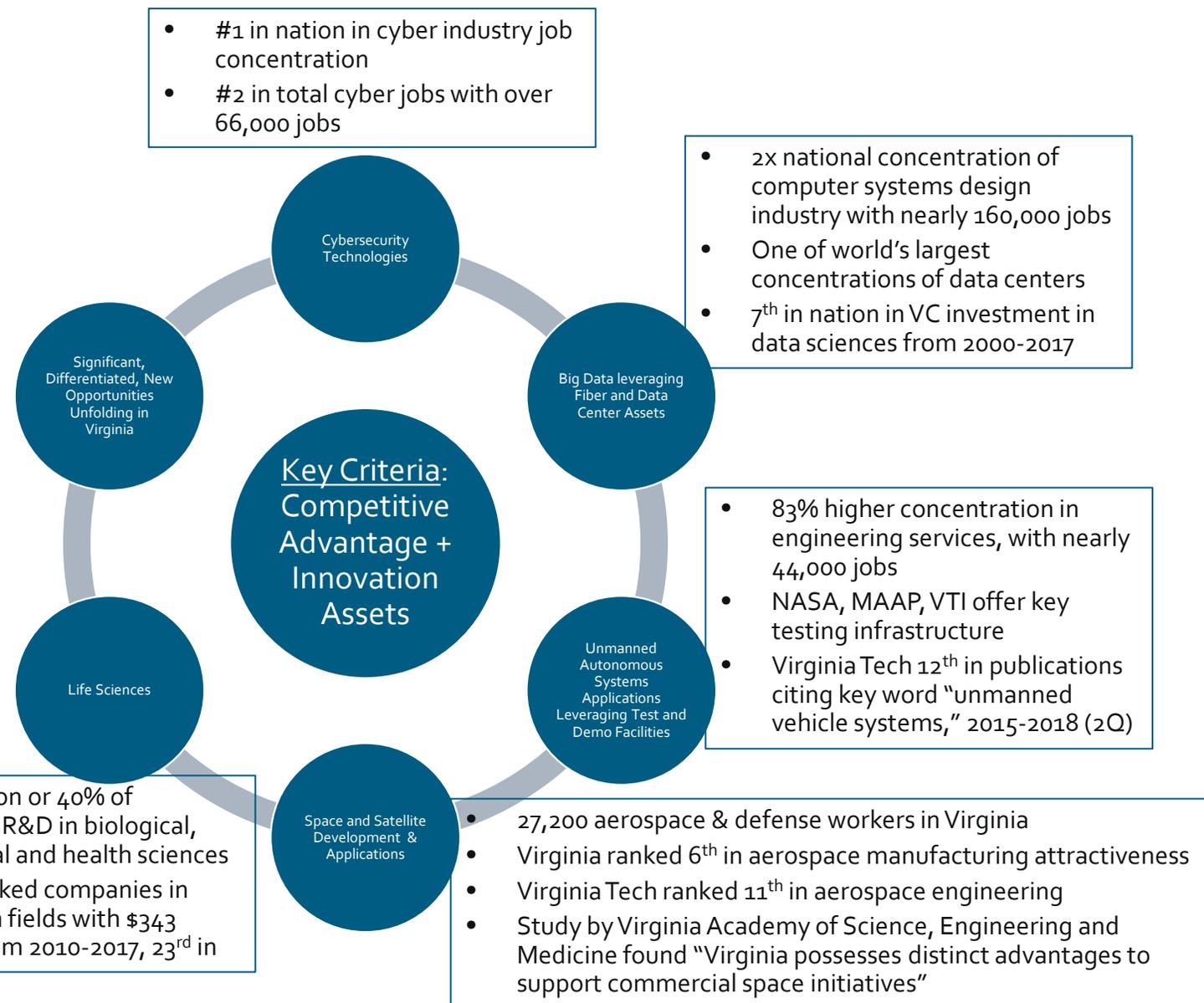
	Bench		Technology Transfer		Technology Commercialization
Stage	<i>Pre-Competitive Research</i>	<i>Applied Research</i>	<i>Discovery to IP Creation</i>	<i>Translational Research</i>	<i>Licensing Activities</i>
Outcomes	<ul style="list-style-type: none"> Largely, federal and philanthropic grants Industry consortium 	<ul style="list-style-type: none"> Help companies identify needed expertise and available IP Individual company sponsored research into application or technology solution 	<ul style="list-style-type: none"> Scouting IP Invention disclosure Provisional patents Seek initial assessment and industry interest Advance to next stage or return to inventor 	<ul style="list-style-type: none"> Deeper market and technical assessment Proof-of-concept to de-risk innovation Go/No-Go decision on intellectual property (patent, copyright, trade secret, open access, etc.) 	<ul style="list-style-type: none"> "Investment grade" ready technologies Engage innovation partners Licensing to startup and existing companies

Suggested Services: *The Bench to Licensing Continuum for Research Commercialization*

- Create individual university research commercialization advancement plans
- Develop a database system on faculty expertise, shared-use facilities and active innovation projects to align with industry capabilities and needs
- Seek legislation that clarifies state policy on goals of university technology transfer and commercialization

Key IAT Guidance: *Focus on Strategic Domain Areas*

Key Function: *Identify Strategic Domain Areas*



Suggested Services: *Market-driven Product Development/Design to New Startup Launch*

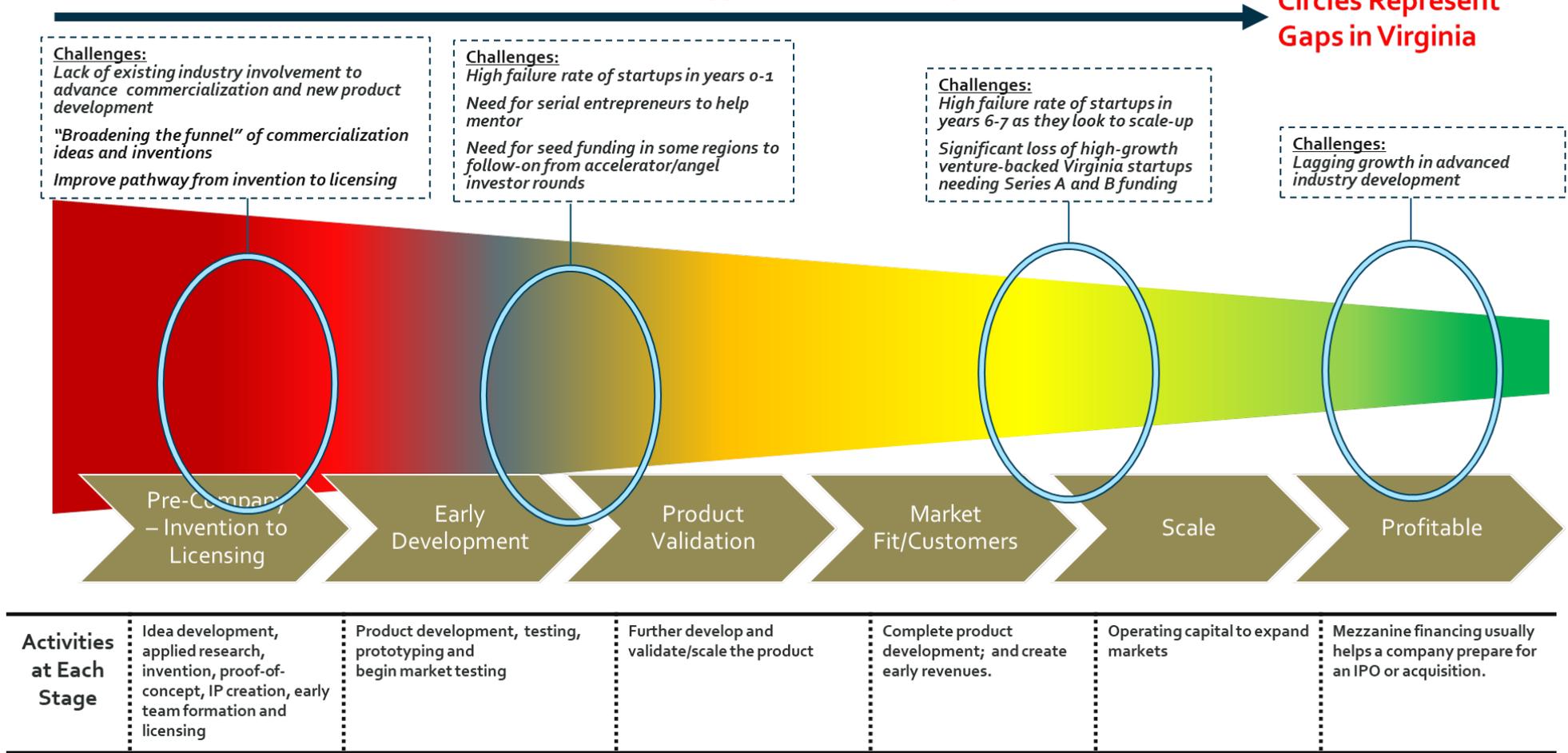
- Identify unmet market needs in technology domain areas
- Pursue applied R&D projects and enhancements aligned with unmet market needs
- Scout for inventions with commercial value
- Inform commercialization questions for proof-of-concept projects to de-risk technologies
- Accelerate new venture formation
- Mentor scaling of emerging ventures

Overview of Leading Strategic Innovation Areas

Targeted Domain Area	Cybersecurity Technologies	Big Data Leveraging Fiber and Data Center Assets	Unmanned Autonomous Systems	Space/Satellite Systems	Life Sciences
Virginia's Competitive Advantage	Presence of federal national security and intelligence agencies advancing "cutting edge" technologies and supporting top talent base	Virginia's ultra-high speed fiber ring and data center concentration established in Loudoun County and growing in Virginia Beach offers unique capabilities for high-intensive computing data sciences markets	Significant federally-sponsored testing and demonstration facilities with active industry engagement associated with universities, including VT Transportation Institute and Mid-Atlantic Aviation Partnership, plus active program at NASA Langley	NASA Langley active in small satellite R&D and state has unique launch capacities for satellites at NASA Wallops Flight Facility Virginia and presence of Mid-Atlantic Regional Spaceport (MARS)	Still emerging, but active area for university research, commercialization and collaboration
Innovation Assets					
Industry Presence	National leader	Specialized base of key industries	Part of specialized engineering services	Base of satellite-related companies and divisions within Virginia's large aerospace industry	Growing industry base and presence of active health systems
Innovation	Industry patent strengths Significant base of venture-backed companies	Industry patent strengths Significant base of venture-backed data sciences companies	Active base of SBIR companies VC investments in over 30 companies since 2010, but small relative to nation	Active base of SBIR companies Handful of VC investments taking place, but small area nationally	Active with 35 companies funded since 2010, but small on national scene Significant patent activity, led by industry with also a substantial university presence
University*	Active, but no one university is national leader or offers large federally-funded research center	University strengths in data mining and analysis at VT and GMU. Major investments by UVA and active research center in modeling/simulation at ODU.	Active efforts across universities, with VT standing 12 th in nation from 2015 to mid-2018 in publications.	Active university efforts, focused around remote sensing, radar/navigation	Largest area of university research and commercialization, but not a national leader in any specific area A number of federally-funded centers in areas, such as cancer, neuroscience, addiction, and translational research

* TEconomy is still vetting sub-areas of university strength within the domain areas

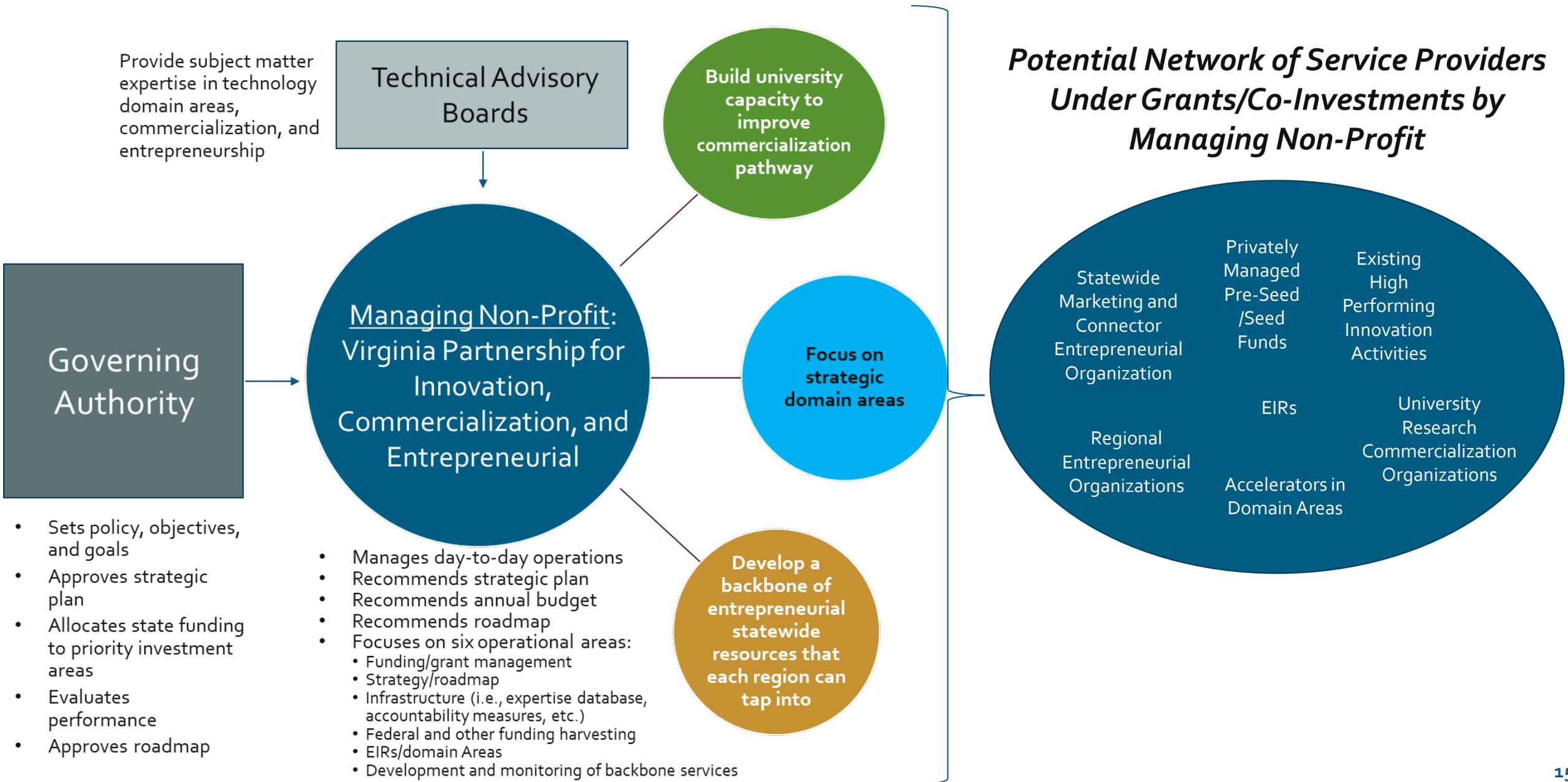
Key Function: *Identify Gaps in Ecosystem*



Suggested Services: Backbone services for entrepreneurship in each region

- In coordination with GO Virginia provide capacity-building funding to regional entrepreneurial service providers to ensure the capacity for entrepreneurial services exists across the state
- Advance public/private partnerships to ensure gaps within risk capital continuum are filled
- Market and coordinate Virginia's entrepreneurial development efforts statewide

Depiction of IAT's Organizational Guidance



Uses of Existing and Enhanced Resources

University Capacity Building

- University research commercialization advancement plans
- Database on expertise and IP

Strategic Domain Areas

- Opportunity scouting by funding entrepreneurs-in-residence
- Commercial innovation project funds
- Accelerate new venture formation
- Enhance university translational and applied research capacities
- Engage graduate students, post-docs and faculty in start-up formation
- Harvest federal funding and other funding source opportunities

Build Entrepreneurial Capacity

- Create regional entrepreneurial service providers/regional quarterback
- Catalyze capitalization of indigenous pre-seed/seed funds
- Market/brand/coordinate Virginia’s entrepreneurial efforts
- Staffing/administration of new organization

Existing Resources

- **Operating Funds: Estimated at \$24 million annually**
 - \$9 million VRIC*
 - \$3.75 million VBHRC
 - \$10 million CIT**
 - \$1 million CHRB
 - \$0.25 million SCHEV
- **Capital Funds: Estimated at \$21 million annually**
 - \$15 million VRIC
 - \$6 million HEETF***
- **Does not include Commonwealth Cyber Initiative (CCI) funding**
- **Does not include any potential GO Virginia funding for entrepreneurial backbone support**

- Notes:
 - *VRIC includes annual appropriations and rollover funding
 - **CIT is portion focused on commercialization, entrepreneurship and staffing
 - ***HEETF is portion dedicated to research enhancement



Budget Uses and Existing Resources

Accountability: Examples of Potential Measures for Tracking Success

Improve the Pathway for Research Commercialization

Stage: Discovery to IP Creation:

- Funding and # of projects in pre-competitive research/applied research to meet industry-driven unmet market needs
- # of invention disclosures

Stage: Translational Research:

- # of completed market assessments for invention disclosures
- # of completed proof-of-concept projects
- # of patent filings and patent awards

Stage: Licensing to Initial New Firm Formation:

- # of licenses executed: total and with start-ups, in-state existing business and out-of-state existing businesses
- Regulatory milestones achieved by products under development in startups or other licensees
- Amount and source of investment capital raised by startups
- Evidence of valuation increases in university startups based on institutional investors or other external sources
- Startup economic footprint: square footage occupied, sales generated, jobs, average salaries, local and state taxes paid, and related economic indicators
- Sales generated by licensing to in-state existing businesses

Focus on Strategic Domain Areas

For each domain area funded, the following success measures will be tracked:

- # of identified unmet market needs validated by customer engagement and market research
- # of invention disclosures generated thru scouting university labs and faculty research
- Results of applied research projects: follow-on funding, IP generated and licenses
- Results of proof-of-concept projects funded: IP generated, licenses and startups formed
- Results of pre-seed investments in startups: follow-on funding, product sales, jobs created

Develop a Backbone of Statewide Entrepreneurial Resources

Entrepreneurial Assistance

- # of companies assisted
- \$ invested in companies receiving entrepreneurial assistance
- Product sales of companies provided entrepreneurial assistance
- Jobs created in companies provided entrepreneurial assistance

Risk Capital

- \$ value of investment
- \$ value of follow-on funding
- \$ value of product sales
- Jobs created in portfolio companies

Marketing/Branding

- # of positive news stories in local markets
- # of positive news stories in national/international markets
- # of entrepreneurial events

Wrap-Up and Next Steps for VRIC

VRIC Action for Today

Seek VRIC vote that:

- a) Accepts the basic guidance brought forward by the IAT
- b) Directs VRIC Chair and IAT Chair to solicit feedback on those tenets from key administration officials, legislators and other stakeholders

Complete By End of November

- Full report on Prospectus to guide potential legislative action

How This Relates to GO Virginia

- **Critical for GO Virginia to ensure “Entrepreneurship” is a key “leg” for a robust and comprehensive regional economic development effort**
 - While it is easy for “headlines” to capture new job creation from successful business attraction efforts, *nearly 50,000 traded sector jobs were created in Virginia by startups* since 2008
 - *Key to sustainability is high growth startups* – disproportionate share of employment in startups exhibiting high annualized growth rates
- **Collaborate with new organization on advancement of backbone services for entrepreneurship in each region**
 - Coordinate entrepreneurial assistance to companies, such as access to mentorship networks, accelerators, Entrepreneurs-in-Residence, etc., to help ensure companies successfully move through the commercialization valley of death
 - Ensure availability of sources of privately managed risk capital
 - Support a statewide marketing and coordinating effort to serve entrepreneurs across the state and match to investors
 - Tap into subject area experts in specific industry clusters
- **Coordinate GO Virginia efforts with VRIC efforts**

GO Virginia Project: Addressing Challenge of Entrepreneurial Development across Regions

Ongoing initial effort to assess entrepreneurial development and unmet needs and priorities for each region.

GO Virginia's project will result in the following deliverables:

- Develop a common template of data, inventory and stakeholder perspectives to help GO Virginia regions develop their own strategic directions
- Offer best practice lessons and benchmarking to national peers
- Have each GO Virginia region prioritize key investments/activities to catalyze the development of a robust innovation ecosystem
- Consider statewide approaches to address common needs and gaps and to provide dedicated capacity to grow

GO Virginia's effort will be leveraging the ongoing work of VRIC in its implementation planning to expand the analysis of entrepreneurial ecosystems across all GO Virginia Regions

Will leverage and expand upon:

- the inventory being developed
- the stakeholder interviews
- the data analysis
- the best practices being identified
- the need for statewide approaches to supporting regional entrepreneurial ecosystems



Innovating Tomorrow's Economic Landscape

TEconomy Partners is a global leader in research, analysis and strategy for innovation-based economic development. Today we're helping nations, states, regions, universities, and industries blueprint their future and translate knowledge into prosperity.

IAT Guidance: More Details on Key Services

Solutions	Activities	Service Delivery Model
<p>Ensure innovation, entrepreneurship, and economic engagement is part of every public university's strategic efforts</p>	<ul style="list-style-type: none"> • Seek legislation that clarifies state policy on the priority for universities to pursue engagement in economic development, including involvement through university technology transfer and commercialization, in its strategic planning • Focus on economic development value creation through commercialization and not revenue maximization • There is precedent for doing this in Virginia. Virginia bills HB 134 and SB 259 were passed in 2006 and codified into law (Code of Virginia § 23-4.4), giving Virginia universities greater flexibility in transfers of IP. 	<p>Each university will establish a plan that demonstrates its commitment to economic development and commercialization, including goals and performance targets.</p>
<p>Create Individual University Research Commercialization Advancement Plans</p>	<ul style="list-style-type: none"> • Develop an individualized plan for each university with specific, measurable goals • Utilize a template across commercialization stages from bench to licensing/initial firm formation based on best practices • Seek out opportunities for collaboration between universities (such as sharing networks of mentors and technology experts, conducting due diligence, etc.) • Pilot innovative approaches (i.e. evaluation licenses, simplified start-up term sheets, etc.) and share best practices 	<p>Managing Non-Profit would co-invest in approved plans to match up to 50% of university own-funding for technology transfer and commercialization activities based on tiers relating to R&D base.</p> <p>Managing Non-Profit will assess performance against institutional plans.</p>
<p>Develop databases on faculty expertise and IP</p>	<ul style="list-style-type: none"> • Create a database system that can update intelligence on faculty expertise, IP available and shared use labs on a routine basis • Enable search tools that can allow industry to search based on specific technology needs (as developed by NASA EIR pilot program) 	<p>Managing Non-Profit would contract out for database system and search tools in collaboration with universities</p>

IAT Guidance: More Details on Key Services

Objective: Focus on strategic domain areas

Solutions	Activities	Service Delivery Model
Catalyze Opportunity Scouting by Funding Entrepreneurs-in-Residence for "Market Pull"	<ul style="list-style-type: none"> • Entrepreneurs-in-residence (EIRs) will facilitate identification of unmet market needs with strong outreach for customer discovery and use of market research • Partner with universities to walk the halls to mine research commercialization focusing around unmet market needs • Offer a database platform on university expertise, IP and capabilities with tools to identify matches with unmet market needs 	Managing Non-Profit funds and may provides services directly or engage domain specific organization
Create Commercial Innovation Project	<p>A competitive strategic investment fund managed by the EIR for each strategic domain area to be used for:</p> <ul style="list-style-type: none"> • Applied R&D grants to advance potential solutions around identified unmet market needs • Proof-of-concept funding for university inventions to de-risk technologies and address initial prototyping • Pre-seed investments for initial efforts towards new company formation, including business planning, augmenting management team, solidifying IP position and initial raising of venture funding 	Managing Non-Profit funds and may manage competition directly or engage domain specific organization
Domain Specific R&D Enhancement Funds (capital funding)	<ul style="list-style-type: none"> • Matching funding for university enhancement to meet unmet market needs from signature facilities to start-up equipment and facilities for entrepreneurial eminent scholars 	Managing Non-Profit funds and manages competition
Accelerate New Venture Formation	<ul style="list-style-type: none"> • On a competitive basis, advance dedicated strategic domain area accelerators operated by proven serial entrepreneurs who can create and manage initial phases of new company formation, recruit management teams, bring the mentor, technical network and investors to support new startups and co-invest in seed funds operated by the accelerator 	Managing Non-Profit co-invests as equity investor into privately managed evergreen funds
Engage graduate students, post-docs and faculty in start-up company commercialization planning	<p>Create a statewide iCorps program, modeled after the NSF program, in targeted domain areas.</p>	Managing Non-Profit funds and contracts for services
Harvest federal funding and other funding source opportunities	<p>Serve as a liaison to commercialization efforts at federal labs, FFRDCs in Virginia associated with strategic domain areas</p> <ul style="list-style-type: none"> • Track major federal lab activities and IP generation in strategic domain areas • Advance commercialization partnership with federal labs and FFRDCs • Identify opportunity for enhancements of federal shared use facilities in strategic domain areas • Identify opportunities for funding by philanthropic and corporate organizations interested in strategic domain areas 	Managing Non-Profit funds and may manages program or contract with other organization

IAT Guidance: More Details on Key Services

Objective: Develop a backbone of statewide Entrepreneurial resources

Solutions	Activities	Service Delivery Model
Coordinate state funding to regional entrepreneurial service providers	Matching funds to: <ul style="list-style-type: none"> Existing regional entrepreneurial service providers based on their performance to enhance their service to fill gaps, broaden their service areas within regions and to target services to high-performing innovation-based companies to support their scale-up efforts Existing accelerators to support cohorts within strategic domain areas 	Managing Non-profit provides competitive matching funds but outsources for services to be provided
Advance public/private partnerships to create a risk capital climate that supports the development, retention, and attraction of investable traded sector, high-growth companies in Virginia	<ul style="list-style-type: none"> Catalyze with matching funds the creation of pre-seed and seed funds with an emphasis/preference on funding companies within the strategic domain areas. Encourage GO Virginia regions to link up and create a multi-regional pre-seed and seed funds to increase the pool of deal flow and better share management costs Foster the organization of angel investor networks by providing funding to be utilized to help defray the costs of fund/operational management/due diligence services. Encourage syndication across regionally-based based funds Create an equity investment fund managed by private investors to create/attract privately-managed Series A and B funds in the strategic domain areas (through a fund-of-funds (FoF) co-investment model) by engaging corporations, foundations and other major investors as limited partners (LPs). 	Managing Non-profit provides competitive matching funds as a limited equity partner. Competitive funding invested in private investment evergreen funds to stimulate indigenous risk capital sources throughout the Commonwealth
Market and Coordinate Virginia's Entrepreneurial Development Efforts Statewide	<ul style="list-style-type: none"> Create a website to serve as a front door for entrepreneurs and investors Help match emerging ventures from across the state with sources of capital Hold pitch competitions, investor forums, and other events to raise the profile of entrepreneurship across the state Partner on major events such as the TomTom Festival 	Managing Non-Profit provides funds but outsources for services to be provided