

Regional Entrepreneurial Assessment Project:

Final Briefing Report

Region 7: Northern Virginia

January 2019

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Overview

The purpose of this briefing report is to provide a high-level baseline assessment of entrepreneurial development and identification of potential priority actions in GO Virginia Region 7 – Northern Virginia.

TEconomy Partners, LLC was engaged by the GO Virginia Statewide Board to provide each GO Virginia region an independent and objective assessment of its entrepreneurial development position, to facilitate a situational assessment of the region's entrepreneurial ecosystem, and to help identify priority actions with local leaders to help strengthen the ecosystem.

Setting the Context: Importance of Entrepreneurial Development for Regional Growth

- In 2017, there were 7,547 surviving traded sector startups formed since 2007 in Region 7
- 56,848 jobs in 2017 were found in these 7,547 surviving startups
- By comparison, over the 2007-2017 period, total traded sector industry employment increased by 20,851 in Region 7.
- So without entrepreneurial growth in traded sector industries, Region 7 would have recorded a **decline of nearly 37,000** in the region's traded sector industry employment from the heights reached before the Great Recession of 2008-2009.

Project Work Plan

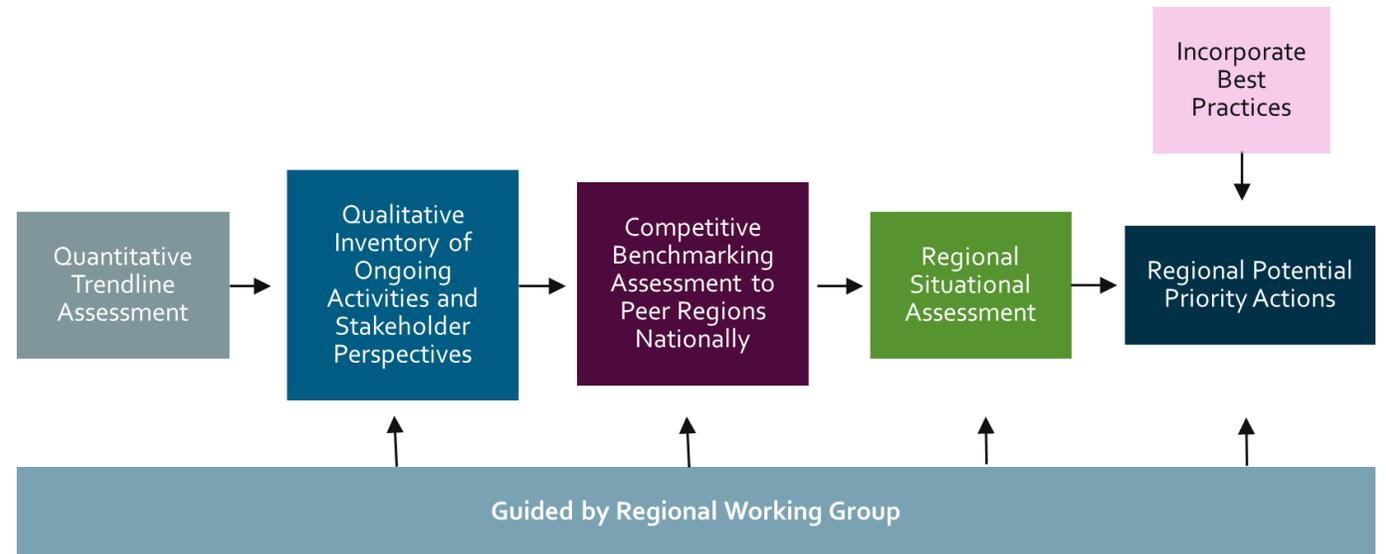
The work plan for preparing this Region 7 entrepreneurial development assessment involved examining:

- Recent data trends in entrepreneurial development
- Ongoing entrepreneurial activities and stakeholder perspectives
- Competitive position to peer regions nationally

These analyses were then utilized to develop a situational assessment of gaps and weaknesses to address and strengths and opportunities to build upon.

Based on the situational assessment and informed by best practices nationally, a set of potential priority actions has been identified for further development by GO Virginia Region 7 to catalyze the development of a robust innovation ecosystem.

Overview of Work Plan for GO Virginia's project:



Strategic Framework: Focus on Entrepreneurial Development Stages Across Traded Sector Industries

Stages of Entrepreneurial Development

Entrepreneurship is a process involving an interconnected set of development stages supported by public and private resources and services that generates successful new startup businesses to drive regional economic growth. If a region is underperforming in any stage of entrepreneurial development, then it will not realize its full potential in traded sector industry development.



Activities at Each Stage	Ideation	Commercial Viability	Market Entry	Growth & Scalability
	Idea development/invention, possibly involving lean startup approaches for identifying end users, market assessment and (if appropriate) IP creation	Customer discovery, new product development, proof-of-concept testing, prototype development, and validation/market testing	New firms that finalize commercial products, add key team members, execute business plans, marketing plans, manufacturing plans, develop supply-chains, and generate early revenues	Critical mass of firms that generate operating capital to expand markets, scale manufacturing, re-examine team member mix, generate new employment, and begin new product development through virtuous cycle supporting vibrant industry clusters
Type of Assistance to Entrepreneurs Needed	Guidance/coaching on gathering insights for business concept development	Domain specific market knowledge on differentiation, positioning, timing to complete and validate a full business model	Execution of business plans, investor outreach, product launch and business development for first customers	Building management team, positioning for IPO, entry into new markets and expanding market presence
Likely Sources of Risk Capital	Sweat equity; friends and family	Proof-of-concept; SBIR; accelerator angel investment, pre-seed	Angel investors; Formal VC investments including seed, Series A and Series B.	Later rounds of venture capital funding; mezzanine/SBIC; SBA (7)a loans

Focus on Entrepreneurial Development in Traded Sector Industries

Of particular importance to GO Virginia is focusing on those new start-ups in traded sector industry activities that serve customers and markets beyond their local communities, and as a result, can drive regional economic growth. It includes industries such as: manufacturing; professional, scientific and technical services; information technology; finance and insurance; transportation and warehousing; mining; and agriculture and food processing.

US Cluster Mapping Project describes the critical importance of a strong base of traded industry sectors :

“[Traded industry clusters] are free to choose their location of operation (unless the location of natural resources drives where they can be) and are highly concentrated in a few regions, tending to only appear in regions that afford specific competitive advantages.

Since traded clusters compete in cross-regional markets, they are exposed to competition from other regions...Traded clusters are the "engines" of regional economies; without strong traded clusters it is virtually impossible for a region to reach high levels of overall economic performance.”

Assessment of Ideation in Region 7

Overall Assessment:

While new business formation is rising and the pool of highly educated workers strong, there are warning signs for Northern Virginia at the ideation stage with lagging growth in top talent and a sharp decline in patent innovation. Northern Virginia does have opportunities to leverage growing university research activities and base of federal research labs.

Strengths and Opportunities:

- **Competitive and rising rates of traded sector new business formation.** Northern Virginia has comparable levels of business formation rates to the median value for large technology hub benchmarks, and in recent years has had strong gains rising from 8% of all traded sector firms in 2014 to 11%-12% level in recent years.
- **Large base of highly educated workforce offers a pool of entrepreneurial talent.** Northern Virginia's working age population with a bachelor's degree stands at 42% compared to 31% for large tech hub benchmarks.
- **Large base of federal research labs,** led by presence of 9 federally funded research and development centers with over \$1.5 billion.
- **A growing base of university research, though still significantly lagging levels of large technology hub benchmarks.** George Mason recently passed the \$100 million milestone in annual funded research, due to a major gains in university research of 29% over the period 2010-2016 that well outpaced national and benchmark gains in the 16-17% range. Plus, other major research universities, including Virginia Tech (computing/national security technologies) and University of Virginia (biomedical), have a growing research presence in the region. Still, large technology hub benchmarks generated a median value of per capita R&D funding of \$863 million compared to \$44 for Northern Virginia.
- **George Mason University has a federally supported capacity in ideation.** GMU is a site for the National Science Foundation-supported iCorps program that prepares faculty/graduate students in using lean startup/customer discovery programs to advance the commercialization of innovations and has created an Innovation Commercialization Assistance Program through the statewide SBDC network it manages to more broadly reach entrepreneurs outside of the university-setting.

Gaps and Weaknesses:

- **Low and declining levels of patent innovation.** Northern Virginia generates four times less patents than the average of large tech hub benchmarks and has realized a 28% decline in patent activity from 2014-2017, while the median gain for benchmark large tech hubs was 16%.
- **Lagging growth of highly skilled talent.** The 7% gain in highly educated working age population for Northern Virginia from 2012-2017 falls below national and state level gains, and is nearly 4 times below the 26% growth in median value of large tech hub benchmarks. Northern Virginia has also not enjoyed the large net in-migration of top talent from other states that the large tech hub benchmarks have recorded, though foreign in-migration of highly educated workers is strong in Northern Virginia.

Assessment of Commercial Viability in Region 7

Overall Assessment:

Significant base of small business innovation in the region, but weakness in research commercialization of university and federal lab innovations.

Strengths and Opportunities:

- **Strong base of SBIR funded companies.** With an average of 171 SBIR awards and just under \$70 million annually over the 2010-2017 period, Northern Virginia has significant base of small and emerging business activity in commercialization. This stands out relative to benchmark regions as well, with Northern Virginia having an average of \$27 per capita from 2014-2017 compared to a median value of \$17 per capita for large tech hub benchmarks.
- **Presence of accelerators, incubators and co-working spaces in the region.** Northern Virginia has a network of accelerator, incubator and coworking spaces, many with access to follow-on capital. The most active effort is in cybersecurity with a defense focus, while other efforts focused on smart city and life sciences. This includes CIT's accelerators in cybersecurity and smart city technologies with potential for follow-on funding from CIT GAP fund, Inova's Personalized Health Accelerator and Seed Fund (though few Virginia companies involved), Prince William Science Accelerator, Mason Enterprise Center and presence of 1776 incubator and seed fund. Stakeholders have suggested that these accelerators in recent years are waning and need to think bigger to support the high-growth potential company formation in Northern Virginia.

Gaps and Weaknesses:

- **Limited research commercialization.** George Mason University technology transfer and commercialization function is just emerging and has limited funding for staffing, patenting and proof-of-concept technology validation. In FY 2018, it had 28 disclosures, 1 patent award, 2 license and 2 startups. The research commercialization of federal lab activities taking place in Northern Virginia is also very limited in the region, with little resources targeted to leverage that base of research for commercial development in the region.

Assessment of Market Entry in Region 7

Overall Assessment:

Young firm growth is an important driver of economic growth in Region 7 years, but lackluster VC activity points to disproportionate concentration of startups in government contracting space.

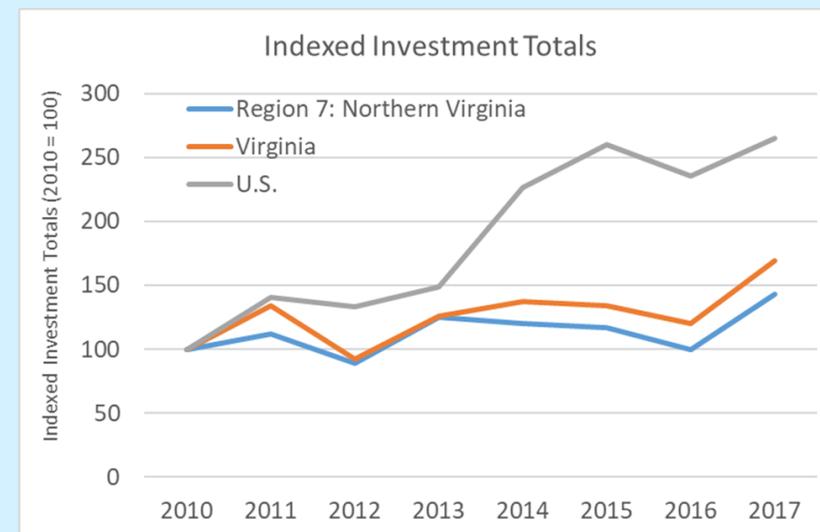
Strengths and Opportunities:

- **Significance of early stage company activity for growing the region** –62% of Region 7's quarterly employment growth over past five years were generated, on average, by firms under five years old compared to 36% for large tech hub benchmark regions

Gaps and Weaknesses:

- **Venture capital levels and growth well below that of large tech hub benchmarks.** On a per capita basis, Northern Virginia is 1/3 lower in venture capital funding over the 2014-2017 period than large tech hub benchmark regions -- \$793 per capita in NoVA compared to \$1,221 per capita for regional peers. Northern Virginia also has fallen short in the growth of venture capital investment, with a gain of just 13% between the 2010-2013 period and the 2014-2017 period. By comparison, the large tech hub benchmarks had a 42% gain ... and statewide, Virginia had a 24% gain.
- **Concerns about access to angel investing for product-oriented companies.** Interviews and a focus group discussion with emerging cybersecurity startups in Northern Virginia raised the concern that angel investors in the region have more knowledge and comfort in investing in technology service rather than product companies.

Venture Capital Falling Off for Region 7



Source: Pitchbook

Assessment of Growth & Scalability in Region 7

Overall Assessment:

Weakness in growth of priority industry clusters and lagging talent dynamics. Bright spot in startup job generation contributions to economic growth, including large number of Inc. 5000 fast growth companies, though heavily concentrated . Opportunity to focus on high-growth potential product companies to create the types of exciting companies that can attract talent to a region.

Strengths and Opportunities:

- **Across priority industry clusters for Northern Virginia, the contribution of startup activity is generally very significant.** Startup growth has exceeded overall net job gains in nearly all of the priority industry clusters for the region.
- **Northern Virginia stands out in large number of Inc. 5000 Fast Growing Privately Held Companies.** With 220 of the Inc. 5000 based in the region, Northern Virginia stands out compared to the median value of 57 for the large tech hub benchmarks . A closer look reveals that 44% of Northern Virginia’s Inc. 5000 are government service providers compared to just 5% of all Inc. 5000 companies in 2018.
- **Active efforts by GO Virginia region to address pressing workforce and talent issues related to cyber skills development and connecting with industry.** Through its Tech Talent Pipeline Initiative, Region 7 is aiming to create a workforce system to effectively attract, prepare, and retain qualified candidates to fill high demand cybersecurity and IT jobs. This includes a new apprenticeship model for IT jobs that seeks to match 400 apprentices to employers as an alternative career pathway to traditional two or four-year degrees.

Gaps and Weaknesses:

- **Lagging or declining job gains in traded sector industry specializations – including Information and Communications Technology, Engineering & Research Services, and Business Services – largely reflecting dependence on federal government.** Both Information and Communications Technology and Business Services grew well below the national growth rate, while Engineering/R&D/Technical Services and Life Sciences declined in the region while growing nationally.
- **Talent dynamics are not favorable for Northern Virginia.** The region lags large tech hub benchmarks in growth of working age population, highly educated working age population and net in-migration of highly educated. Most alarming is that overall population growth of young working age population, 25-34 years old, declined by 4% in Northern Virginia while growing 7% nationally and 11% in large tech hub benchmarks, suggesting the region is not succeeding in attracting young talent.

Growth of Region 7 Priority Industry Clusters Compared to National Average

Industry Cluster	2017 Jobs	Region 7 2007-2017 Percentage Job Growth	U.S. 2007-2017 Percentage Job Growth
Business Services	112,589	5.4%	9.1%
Engineering, R&D, Testing & Technical Services	41,025	-13.6%	6.5%
Financial & Insurance Services	27,974	10.4%	-4.1%
Information Technology & Communications Services	123,862	14.9%	50.8%
Life Sciences	6,041	-26.5%	9.7%

Contribution of Entrepreneurial Development to Priority Industry Cluster Growth for Region 7

Industry Cluster	Net Job Growth, All Companies, 2007-2017	Net Job Growth, Startups, 2007-2017	Share Start-ups of All Net Job Growth, 2007-2017
Business Services	5,812	24642	424%
Engineering, R&D, Testing & Technical Services	-6,434	4982	>100%
Financial & Insurance Services	2,626	6164	235%
Information Technology & Communications Services	16,027	12732	79%
Life Sciences	-2,174	1815	>100%

Source: Business Dynamics Research Consortium Database

Potential Priority Actions Identified for Entrepreneurial Development in Region 7

The Context:

- Northern Virginia facing dynamic of slower growth across nearly all priority industry clusters than the nation, less venture capital activity and slower growth of highly educated talent and overall workforce.
- Startup activity in traded sector industries have been a critical driver of economic growth in Northern Virginia, but is not generating the in-flow of talent found in other large tech hubs.

Recommended Approach to Potential Priority Actions:

- *Take measured and complementary steps in commercial product-oriented entrepreneurial development to leverage the Amazon moment and reverse the lose of competitive edge in Northern Virginia economy in order to attract talent by the tens of thousands and give Northern Virginia a more balanced economy with a strong foundation of government contractors, a hub of new activities advanced by Amazon and a rising commercial product-based economy propelled by exciting venture backed new company startups*

Potential Priority Actions:

- Target increased ideation for SBIR companies, universities and federal laboratories to create product-oriented startups
- Pursue “grand challenges” in artificial intelligence or other technologies with strong commercial sector interest to raise the region’s profile as a technology leader to attract top talent
- Address need for more startup risk capital for early-stage market entry by product-oriented startup companies

Potential Priority Action: Target increased ideation for SBIR companies, universities and federal laboratories to create product-oriented startups.

Rationale:

Region 7 has significant opportunities to further ideation to create exciting, product-oriented companies, including:

- Leveraging the significant federal lab research base in the region for advancing new innovation-led startups
- Taking advantage of the strong research growth and emergence of technology transfer and commercialization at GMU and growing research presence of VT and UVA in the region to build a stronger community-wide approach for advancing university-related startups that taps the local entrepreneurial community.
- Supporting the commercialization success of the region's significant base of SBIR companies.

Possible Activities:

- **Advance a regional industry-university collaborative for innovation and commercialization** to engage seasoned entrepreneurs and technology domain experts from industry to help vet university disclosures, inform needed proof-of-concept projects to validate commercial viability and form or mentor startup teams with university faculty and graduate students
- **Sponsor entrepreneurs-in-residence fellows in targeted sectors relevant to Region 7 to work with identified regional entrepreneurial startup teams**, both from university and broader community, that successfully complete initial phases of ideation program and demonstrate high-growth potential
- **Make available to all SBIR companies access to GMU's Innovation Commercialization Assistance Program**, which will require funding support for additional trainers and counselors.

Illustrative Best Practice Examples:

- Raleigh-Durham: Blackstone Entrepreneurs Network North Carolina that provides expert venture coaching through a veteran group of EIRs in close association with universities in the region.
- Colorado: Innovation Center for the Rockies, initially established by Boulder County, over nearly a decade worked closely with the state's public research universities to bring expert teams of entrepreneurs and technology domain experts to assess and advance university technology transfer. From 2005-2015, beyond the ongoing review of disclosures, it worked with 80 university research teams to commercialize technologies and its experts were directly involved in the startup of 8 new companies, raising \$75 m in private capital and creating over 400 jobs. Now integrated into Innosphere, a technology incubator with facilities across Colorado, including Fort Collins, Boulder, Denver, and South Denver/Castle Rock

Potential Priority Action: Pursue “grand challenges” innovation competition to raise the region’s profile as a technology leader to attract top talent

Rationale:

Despite its strong base of highly educated talent, Region 7 has not fared well in the overall growth of highly educated workers, including in-migration from other states. Combined with declines in younger workers aged 25 to 34, the Region must make an effort to raise its attractiveness to top talent.

One approach is to directly engage top undergraduate and graduate students from outside of the region to be part of entrepreneurial experiences in Northern Virginia around grand challenges that leverages specific areas of technology strength found in the region, including:

- Cybersecurity
- Data sciences, including the significant fiber assets and concentration of data centers
- Geospatial intelligence
- Bio-informatics (with major investments by Inova, UVA, GMU and HHMI)

Possible Activities:

Design and implement a “grand challenges” initiative that features:

- Industry sponsors around technology strengths in the region, who in addition to funding the challenges, can identify key topics and mentors for students recruited into the program.
- Seek out universities in Virginia and around the nation to participate in a “call for innovation ideas” around the grand challenges.
- Hold a pitch competition and select top student teams for a summer global challenge acceleration program.
- Create a grand challenge symposium event around the pitch competition.
- For selected winners, host a grand challenge summer accelerator that leverages the ICAP program as a tool to work with the top student teams on customer discovery, engages with industry mentors to advance the technology solution and offers \$25,000 to \$50,000 per team to defray living and business costs.

Illustrative Best Practice Examples:

- Des Moines: The Global Insurance Accelerator (GIA) is an excellent example of how a focused effort that engages a leading local sector can be leveraged to create an ongoing set of engagements beyond simply working with the selected project teams addressing new technology solutions with active engagement of industry mentors. It has created a week-long InsurTech event in the Fall that involves innovation presentations, networking, educational programs and one-on-one match-making, plus has a two-day Symposium event that attracts over 500 attendees across 200 organizations for panel discussions, presentations from project teams that are graduating from the GIA and keynote speakers.
- Many industry associations feature grand challenges to attract talent to the field, such as the American Society of Civil Engineers Innovation Contest that was developed as part of the ASCE Grand Challenge, now in its fourth year. It seeks out innovative solutions on identified innovation areas for infrastructure development

Potential Priority Action: Address need for more startup risk capital for early-stage market entry by traded sector startup companies

Rationale:

The availability of venture capital focused on formation and growth of exciting product-oriented startup companies is a key intervention that can signal, along with the Amazon decision, the attractiveness of the region to top talent.

Northern Virginia falls well short of large tech hub peers in venture capital levels and growth of venture capital.

Concerns have also been raised by cyber entrepreneurs about access to angel investing for product-oriented companies.

Possible Activities:

As Region 7 focuses on generating deal flow that has a stronger commercial product orientation in its ideation activities, it also needs to address advancing access to angel and seed stage funding:

- **Seek to form a multi-regional seed fund with nearby regions** that is able to bridge angel investors and more formal venture capital, with ability to lead syndication at seed stage and participate in follow-on early stage rounds
- **Organize a formal angel investor network targeted to product-oriented startups in the region.** Given lack of understanding of product-oriented startups by high-net worth individuals consider creating an in-house capacity to conduct due diligence with support from GO Virginia

Illustrative Best Practice

Example:

- Ohio Third Frontier: 34 pre-seed or seed funds established across regions of Ohio, capitalized at approximately \$6-\$7 million on average.

Proposed GO Virginia Action: *Establish Regional Quarterbacks for Entrepreneurial Development in Each GO Virginia Region*

Specific Activities:

- Identify opportunities and needs for regional entrepreneurial development within traded sector industries
- Ensure an implementation capacity on priority actions
- Provide a “front door” in each region for entrepreneurs to receive coordinated services among service providers

Service Delivery Approach:

- Performance-based grants developed in consultation with each region to address priorities
- In each region, an advisory committee will be created to oversee the efforts of the regional quarterbacks
- Potential for multi-regional applications
- VRIC proposal articulates additional entrepreneurial activities that need to be coordinated with the regional GO Virginia efforts

Budget Rationale:

- Award \$200k-\$300k per region to fund a full-time professional to serve as the regional quarterback. Funding could yet be made available in FY 2019.
- The regional quarterback would be tasked with advancing a regional strategic plan and prioritizing strategic investments, with the input from regional entrepreneurial ecosystem stakeholders, under the auspices of the GOVA Regional Boards.
- Once a regional prioritization investment plan is developed, further funding would be available in FY 2020 and thereafter to fill the gaps identified, including funding for efforts such as: EIRs, incubators, accelerators, mentor networks, etc.

Comparable Best Practice Model: *Launch Tennessee*

- Supports a network of Entrepreneur Centers, located in six cities across the state that provide entrepreneurs access to a mix of support services, including: wayfinding for entrepreneurs, boot camps, mentorship, co-working space, and initial pre-seed grants.
- In 2016, Launch Tennessee made grants to its Entrepreneur Centers of \$200,000 to \$375,000 for each center. These centers serve a much smaller area than GO Virginia regions.

Appendix A: Quantitative Trendlines on Entrepreneurial Development

Initial Analysis of Entrepreneurial Dynamics in Your Region's Traded Industry Sectors

Key Measures:

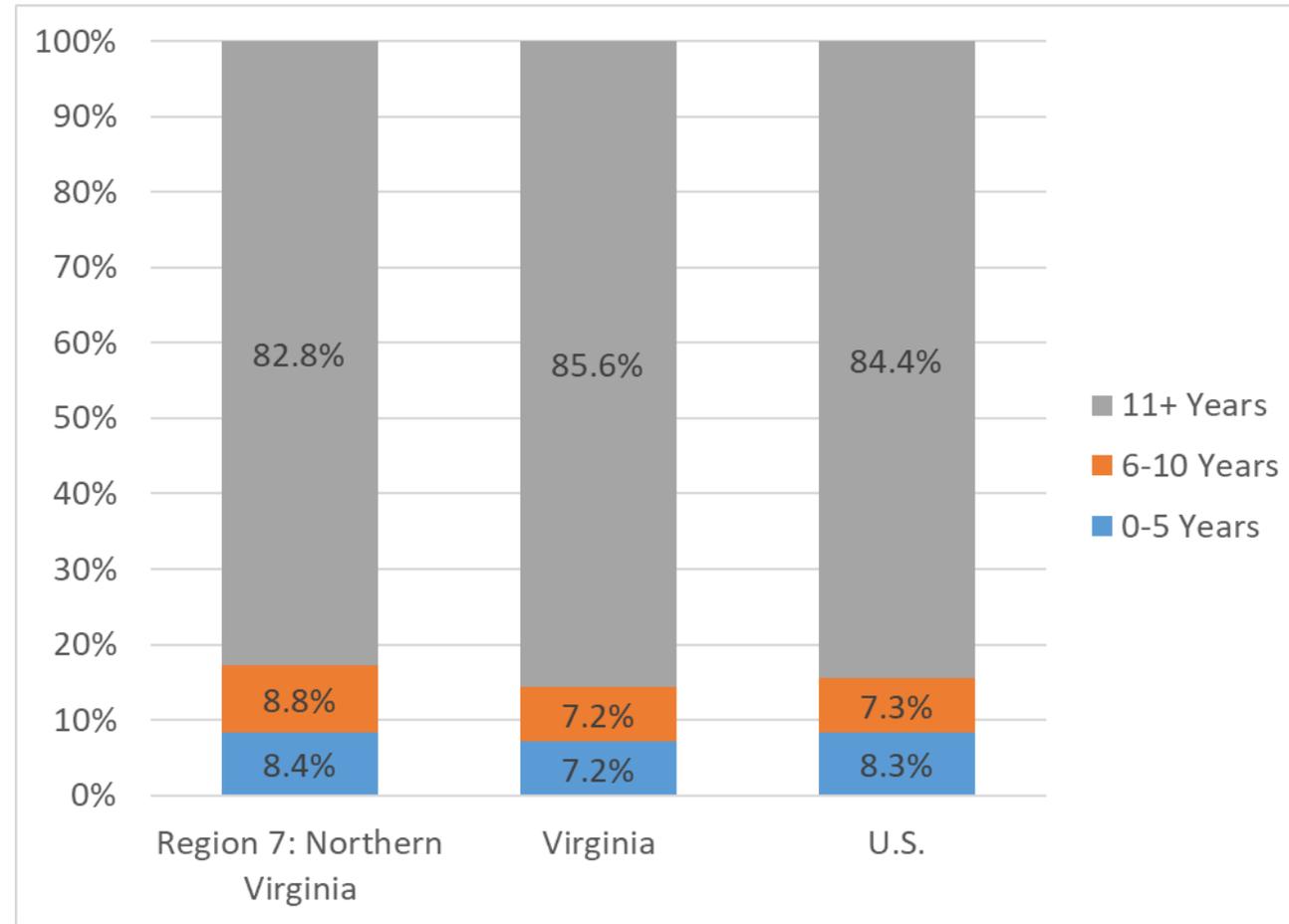
- Job distribution by age of firm
- Job creation by age of firm
- Business formation rates of start-ups
- Survival rates of startup companies
- Examining key elements of “net” employment growth
- The contribution of high-growth startups compared to all startups

Note on Data Sources:

- Two data sources used to provide a full depiction of entrepreneurial dynamics:
- ***The Quarterly Workforce Indicators (QWI) from U.S. Census*** is a new longitudinal database with detailed data related to the job creation and other characteristics of firms, including by age groupings.
 - ***Most Detailed Level of Geographic Coverage:*** County
 - ***Coverage:*** Covers over 95% of U.S. private sector jobs (does not cover ag jobs, self-employment)
 - ***Grouping of Employment by Age of Firms:*** 0-1 Years; 2-3 Years; 4-5 Years; 6-10 Years; 11+ Years
 - ***Industry Coverage:*** 2-digit industry, which can define at a high-level traded sector industries
 - But QWI does not provide intelligence at the firm level
 - All data is on a quarterly basis
- **The Business Dynamics Research Consortium (BDRC) database** is a time-series dataset that catalogues individual establishments by location, employment, sales, and industry from 1997 to 2017. The BDRC is maintained by the University of Wisconsin
 - Coverage: It compiles multiple data sets to track performance and growth for more than 144 million individual businesses across the United States.
 - Provides extensive firm level data
 - Able to identify firm by address
 - Detailed industry coverage

Regional Employment Distribution by Age of Firm for Traded Sector Industries

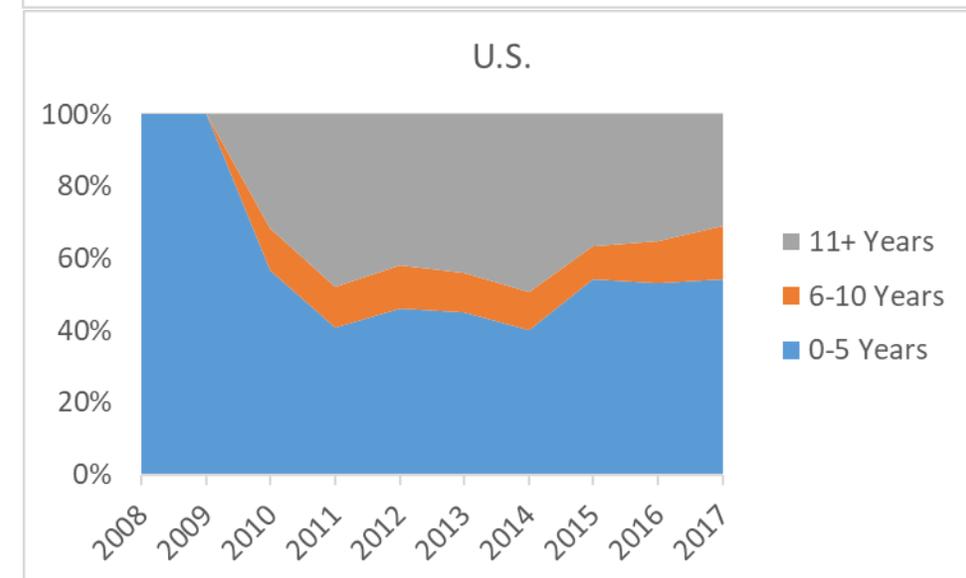
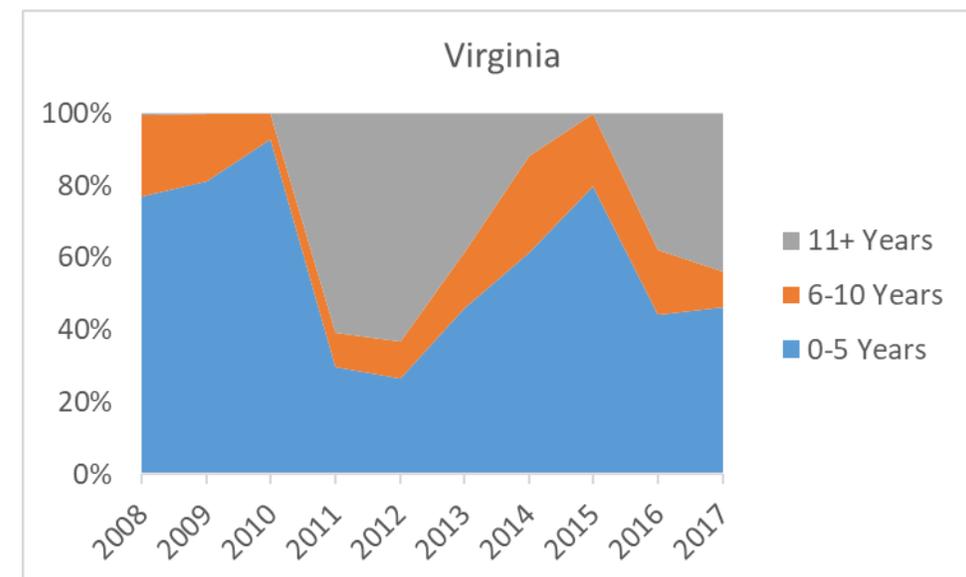
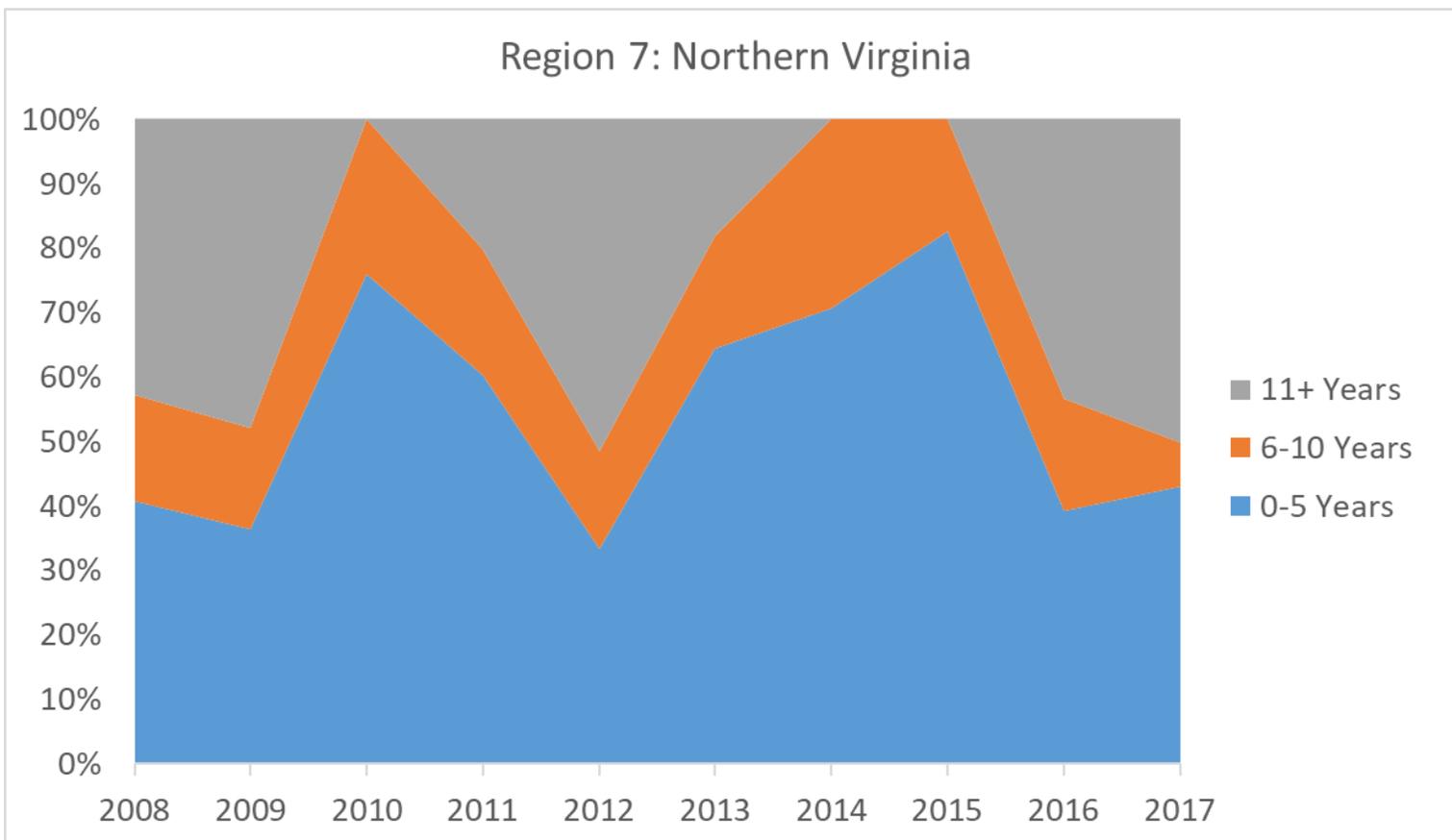
- Majority of employment base is contained within older firms, mirroring wider state and national trends



Traded Sector Employment Levels by Firm Age as a Percentage of Total Employment, Averaged 2008 Q1 through 2017 Q2

Trends in Job Growth Generation by Age of Firm for Traded Sector Industries

Traded Sector Net Job Change by Firm Age, 2008 Q1 through 2017 Q2



There is considerable variability in the number of companies started each year and the churn among startups. Survival rates decline with age as companies approach their first 10 years.

In 2010, 2,101 traded sector companies were launched in Northern Virginia; 738 were still active in 2017 (35.1% survival rate), and these 738 companies have created 4,549 jobs.

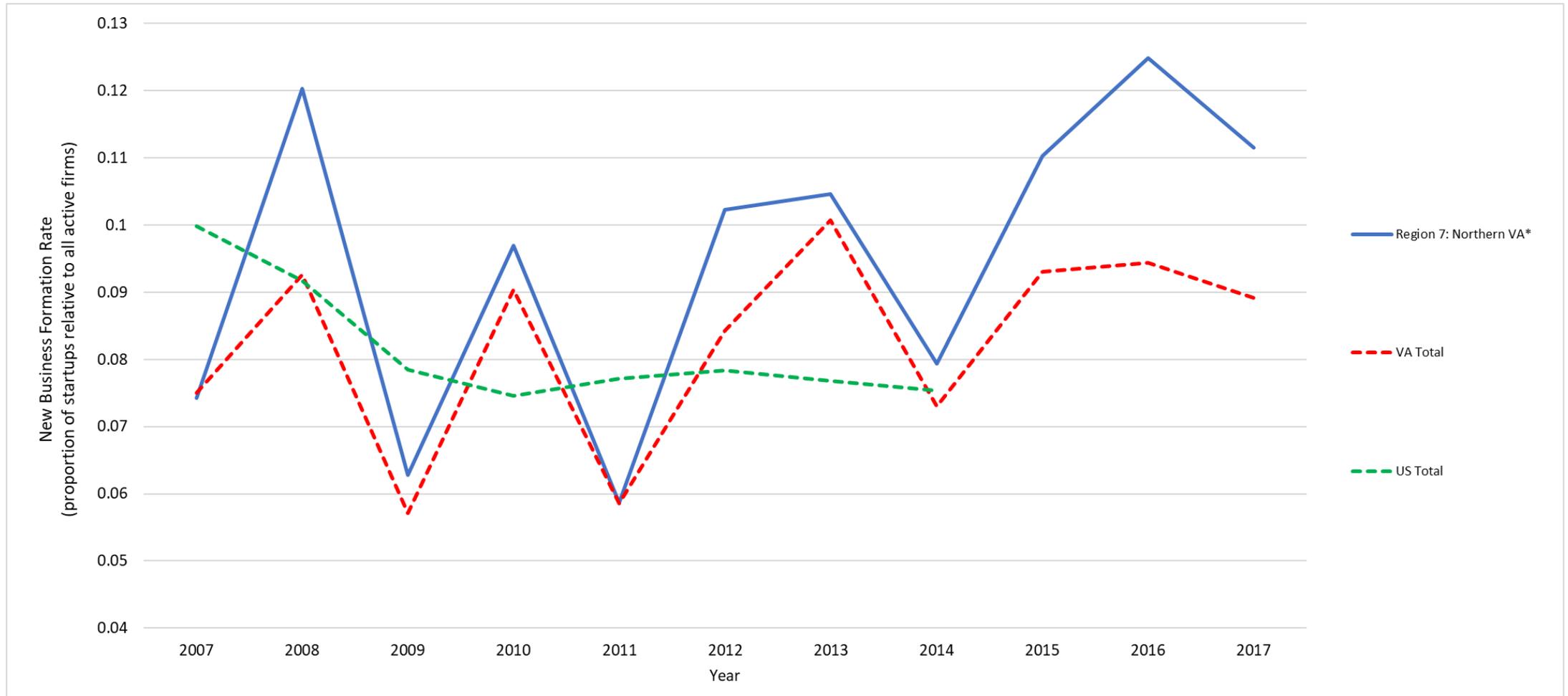
Founding Year of Startup Cohort*	Number of Startups in Traded Sector Industries	Number of Startups Surviving by 2017	Survival Rate by 2017	Start-up Employment Levels 2017
2007	1,377	461	33.5%	4,355
2008	1,842	598	32.5%	6,848
2009	1,060	376	35.5%	3,932
2010	2,101	738	35.1%	4,549
2011	895	399	44.6%	2,777
2012	2,056	944	45.9%	5,991
2013	2,175	975	44.8%	7,016
2014	1,331	806	60.6%	6,024
2015	1,663	1,049	63.1%	6,811
2016	1,884	1,201	63.7%	8,545
2017	1,500	1,500	100%	8,118

Source: Business Dynamics Research Consortium database

Note: *Composed of all new non-branch firms with first recorded employment activity in a given year

Overall New Business Formation Rates for Region Based on BDRC Firm Level Data

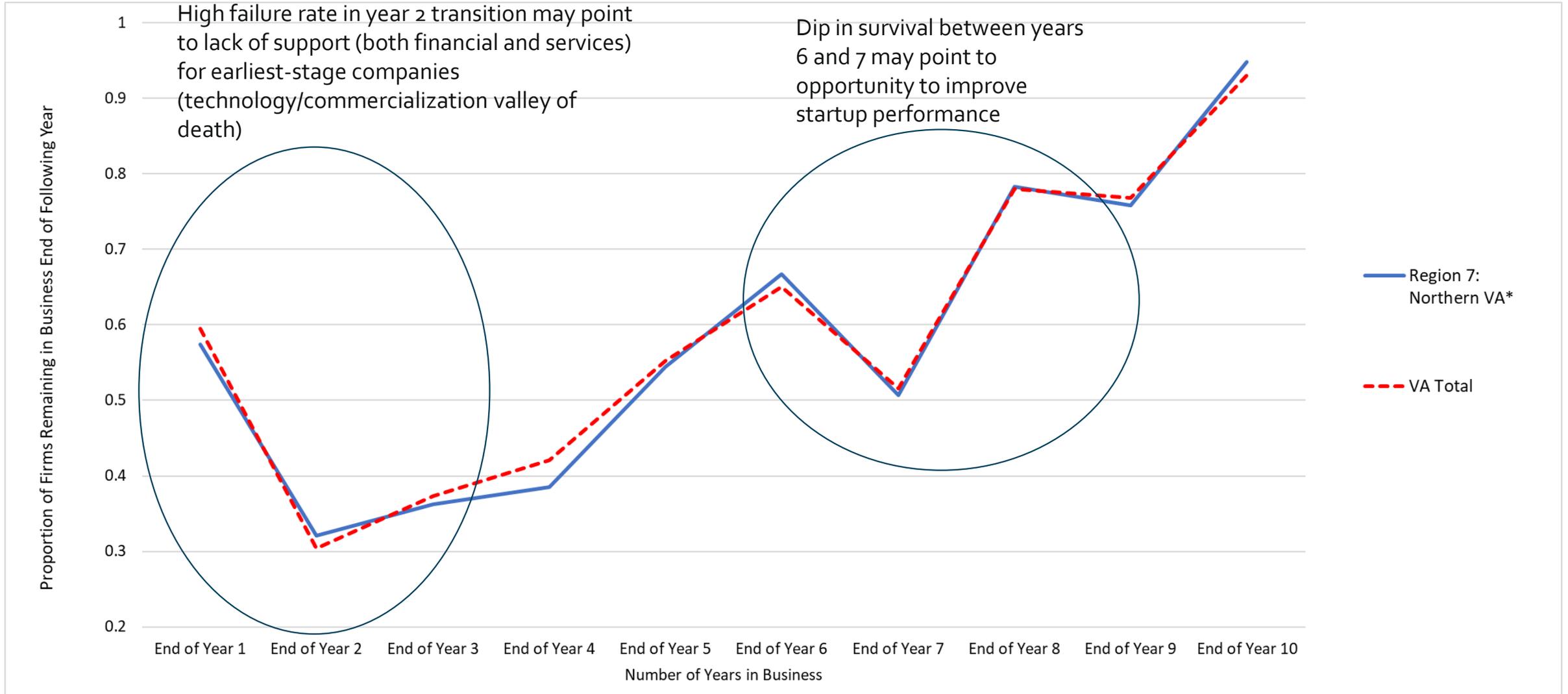
- Trends in overall new business formation rates consistently outperform state levels



*US new business formation rates available to 2014 via US Longitudinal Business Database

Year over Year Survival Rate Trends in Regional Traded Sector Startups

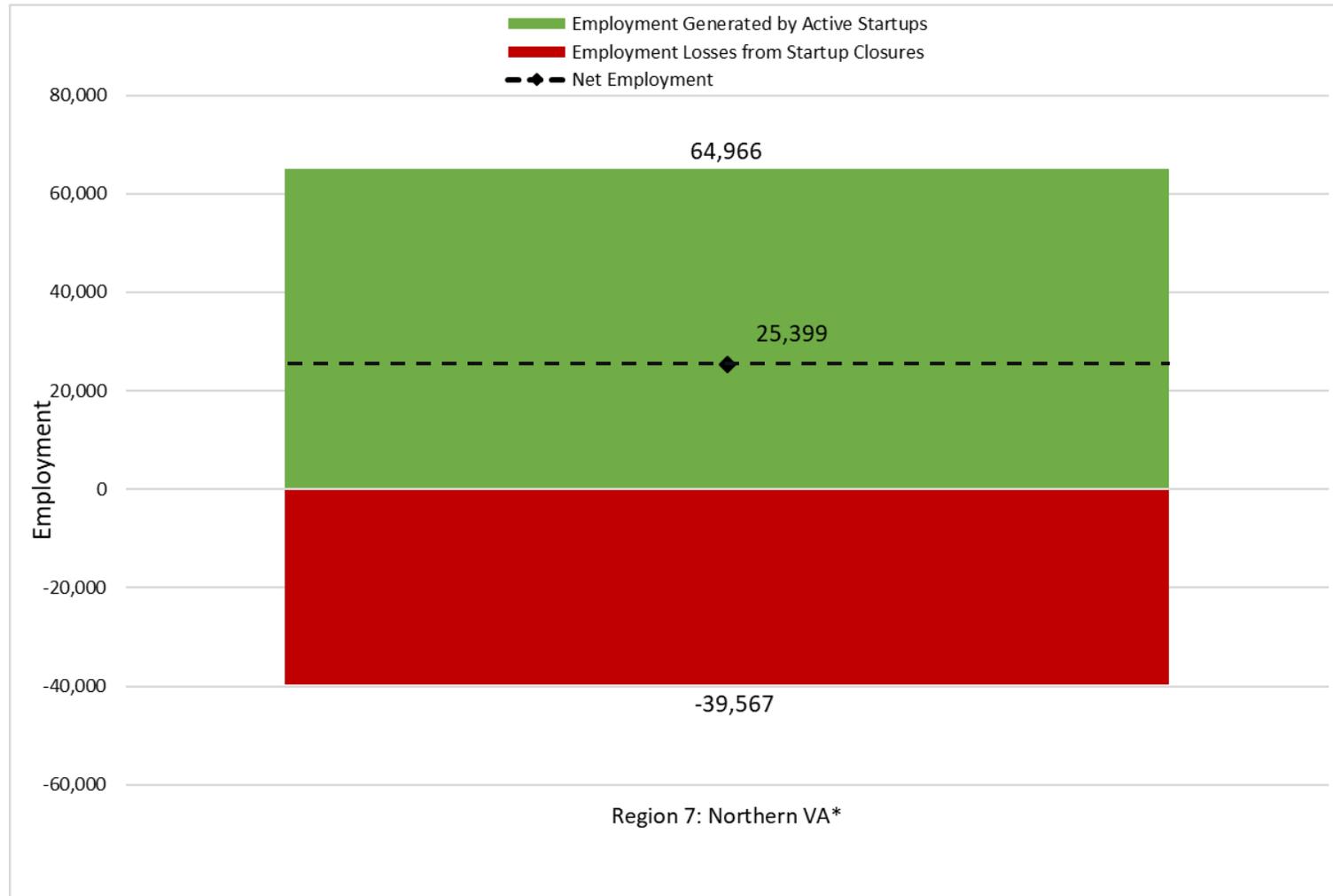
Cumulative 10-year startup cohort survival rates for region are 53.9% compared to a VA statewide rate 53.5%



*Startups defined as having firm age <10 years as of 2017

Net Employment Impacts Generated by Traded Sector Startup Firms in VA

- Significant churn within startups, though generally net employment gains from those surviving startup firms outpaces employment loss from failures across region



	Total Virginia Startups
Employment Generated by Active Startups	155,033
Employment Losses from Startup Closures	-98,732
Net Employment	56,301

*Indicates GO Virginia regions with research universities
 **Startups defined as having firm age <10 years as of 2017

Profile of Traded Sector High Growth Startup* Activity in Region

Founding Year of Startup Cohort**	Total Number of Startups in Traded Sector Industries	Number of High Growth Start-ups in Traded Sector Industries*	Number of High Growth Start-ups Surviving by 2017	Employment Levels of High Growth Start-ups, 2017
2007	1,377	137	52	1,503
2008	1,842	219	80	2,496
2009	1,060	116	45	1,631
2010	2,101	127	54	1,235
2011	895	119	54	1,092
2012	2,056	397	168	2,306
2013	2,175	293	196	3,176
2014	1,331	319	232	3,308
2015	1,663	362	283	3,022
2016	1,884	24	24	539
2017	1,500			

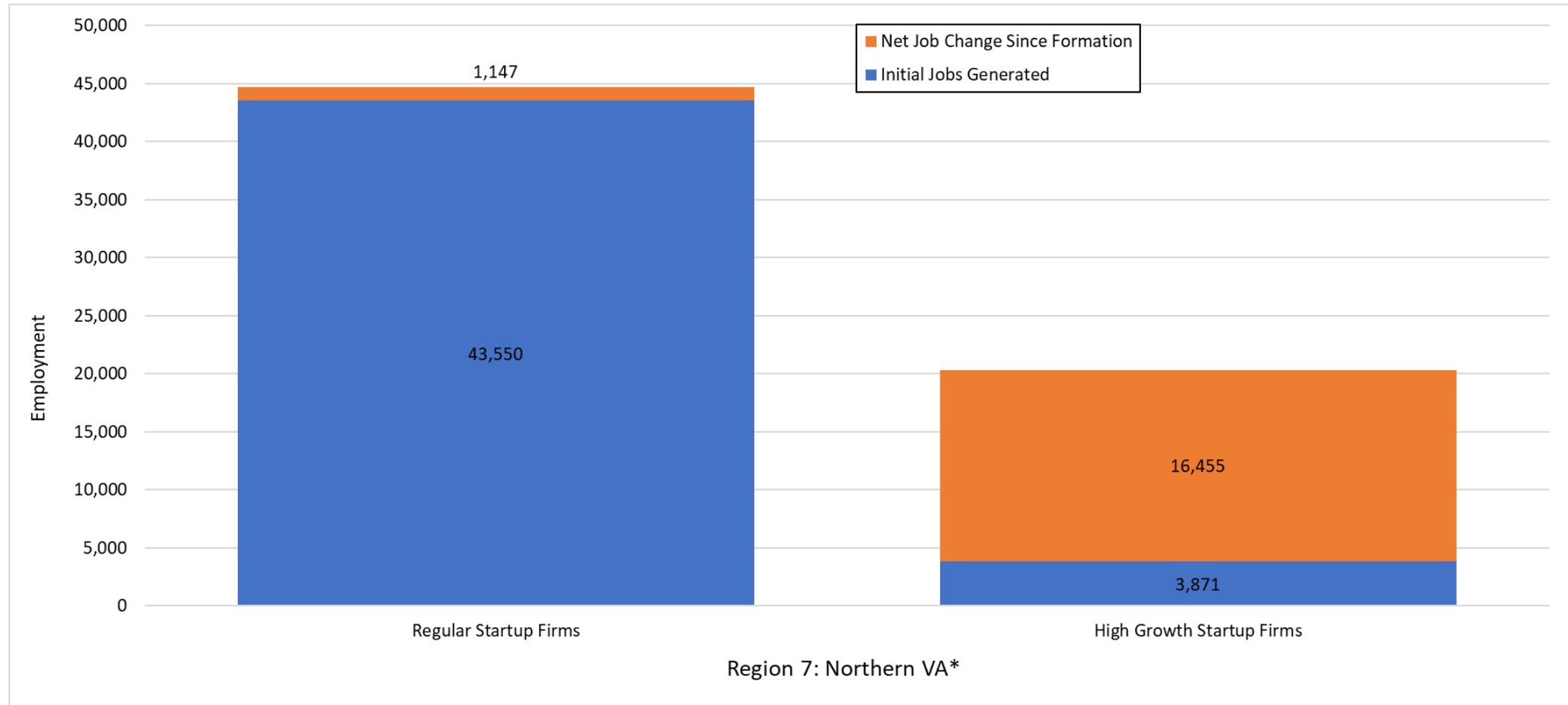
* High growth startups defined as >25% annualized employment growth over lifetime of business

** Composed of all new non-branch firms with first recorded employment activity in a given year

Employment Growth Impacts Generated by Current Traded Sector Startup Firms in Region

- Key to long term success is high growth startups – disproportionate share of lasting gains in employment observed from cohort of startups exhibiting high annualized growth rates

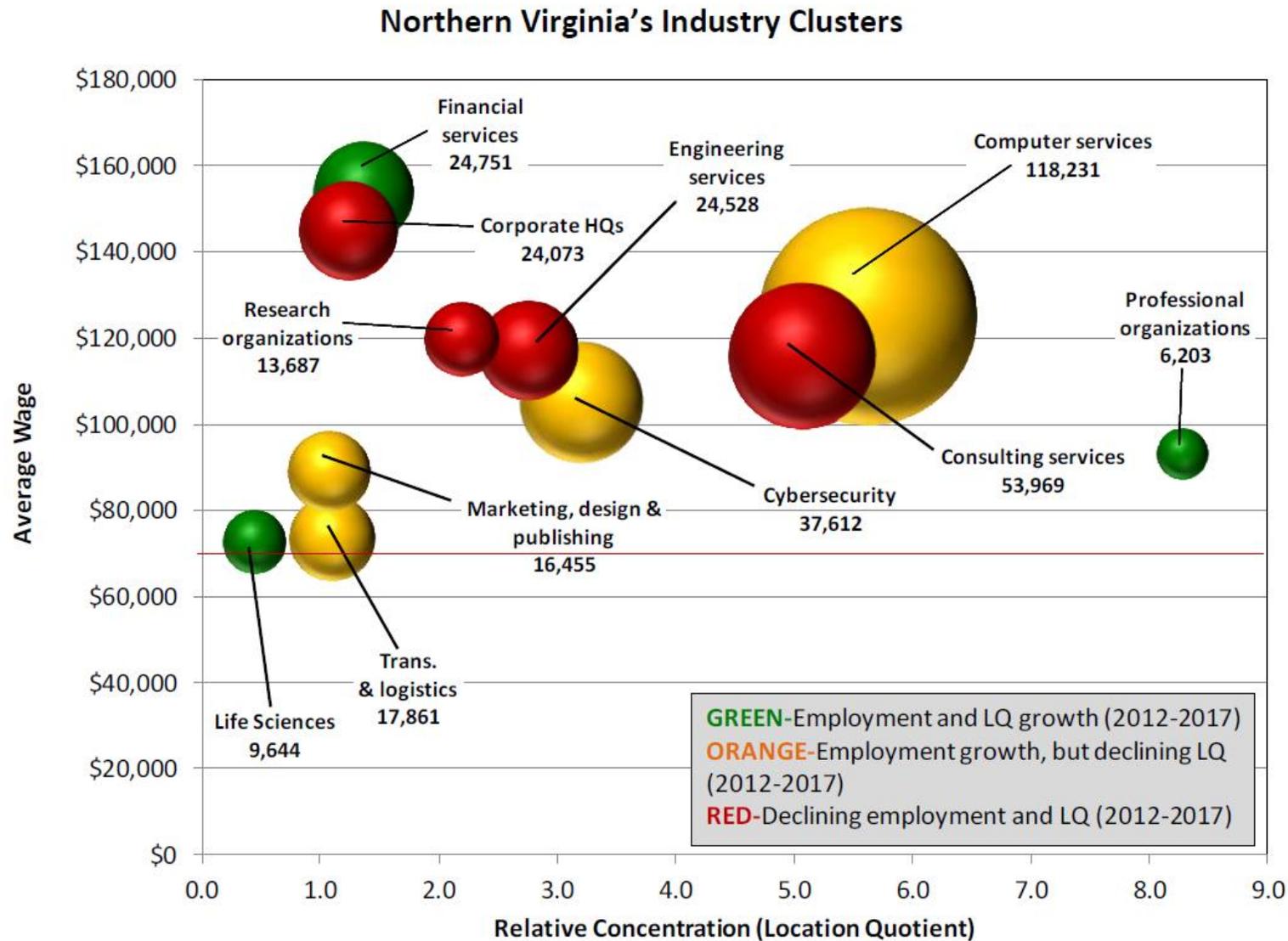
	Total VA Regular Startup Firms	Total VA High Growth Startup Firms
Initial Jobs Generated	104,889	9,058
Net Job Growth Since Formation	506	40,781



*Indicates GO Virginia regions with research universities

**Startups defined as having firm age <10 years as of 2017, high growth startups defined as >25% annualized employment growth over lifetime of business

Northern Virginia's three largest industry clusters—computer services, consulting services, and cybersecurity—are heavily driven by government contracting.



Source: Chmura Economics JobsEQ, 2017 Q1; Clusters defined by US Cluster Mapping Project

Profile of Startup Activity Within Key Regional Industry Clusters

Region 7 Priority Clusters from 2017 Growth and Diversification Plan:

- Computer Services
- Cybersecurity
- Consulting Services
- Financial Services
- Engineering Services
- Research Organizations
- Life Sciences

Major Industry Cluster***	Number of Startups in Cluster	Number of Start-ups Surviving by 2017	Start-up Employment Levels, 2017	Start-ups Industry Cluster Employment Concentration Index*	Number of High Growth Start-ups in Cluster**
Agriculture & Food Processing	383	230	1,271	0.51	38
Business Services	8,585	4,619	24,642	1.21	678
Energy, Natural Resources, & Finished Products	294	156	1,127	0.39	29
Engineering, R&D, Testing & Technical Services	979	540	4,982	1.12	142
Financial & Insurance Services	2,349	1,107	6,164	1.36	169
Health Care Services	154	91	1,286	0.27	28
Information Technology & Communications Services	1,960	1,206	12,732	1.96	366
Life Sciences	527	245	1,815	1.04	59
Manufacturing	544	308	2,369	0.73	53
Ship Building, Aerospace, & Defense	76	36	917	1.71	22
Transportation, Distribution and Logistics	3,175	1,425	9,457	0.94	379

*Represents a measure of specialization in startup activity in certain industry clusters given overall state trends, >1.2 indicates highly specialized concentration of startup generation in industry area

**Defined as >25% annualized employment growth over lifetime of business

***Note: some industry cluster definitions include a mix of traded and untraded industry sectors

Industry Cluster	2017 Jobs	Region 7 2007-2017 Percentage Job Growth	U.S. 2007-2017 Percentage Job Growth
Business Services	112,589	5.4%	9.1%
Engineering, R&D, Testing & Technical Services	41,025	-13.6%	6.5%
Financial & Insurance Services	27,974	10.4%	-4.1%
Information Technology & Communications Services	123,862	14.9%	50.8%
Life Sciences	6,041	-26.5%	9.7%

Industry Cluster	Net Job Growth, All Companies, 2007-2017	Net Job Growth, Startups, 2007-2017	Share Start-ups of All Net Job Growth, 2007-2017
Business Services	5,812	24642	424%
Engineering, R&D, Testing & Technical Services	-6,434	4982	>100%
Financial & Insurance Services	2,626	6164	235%
Information Technology & Communications Services	16,027	12732	79%
Life Sciences	-2,174	1815	>100%

Additional Data Insights – Region 7 Contribution of Entrepreneurial Development to Leading Industry Clusters

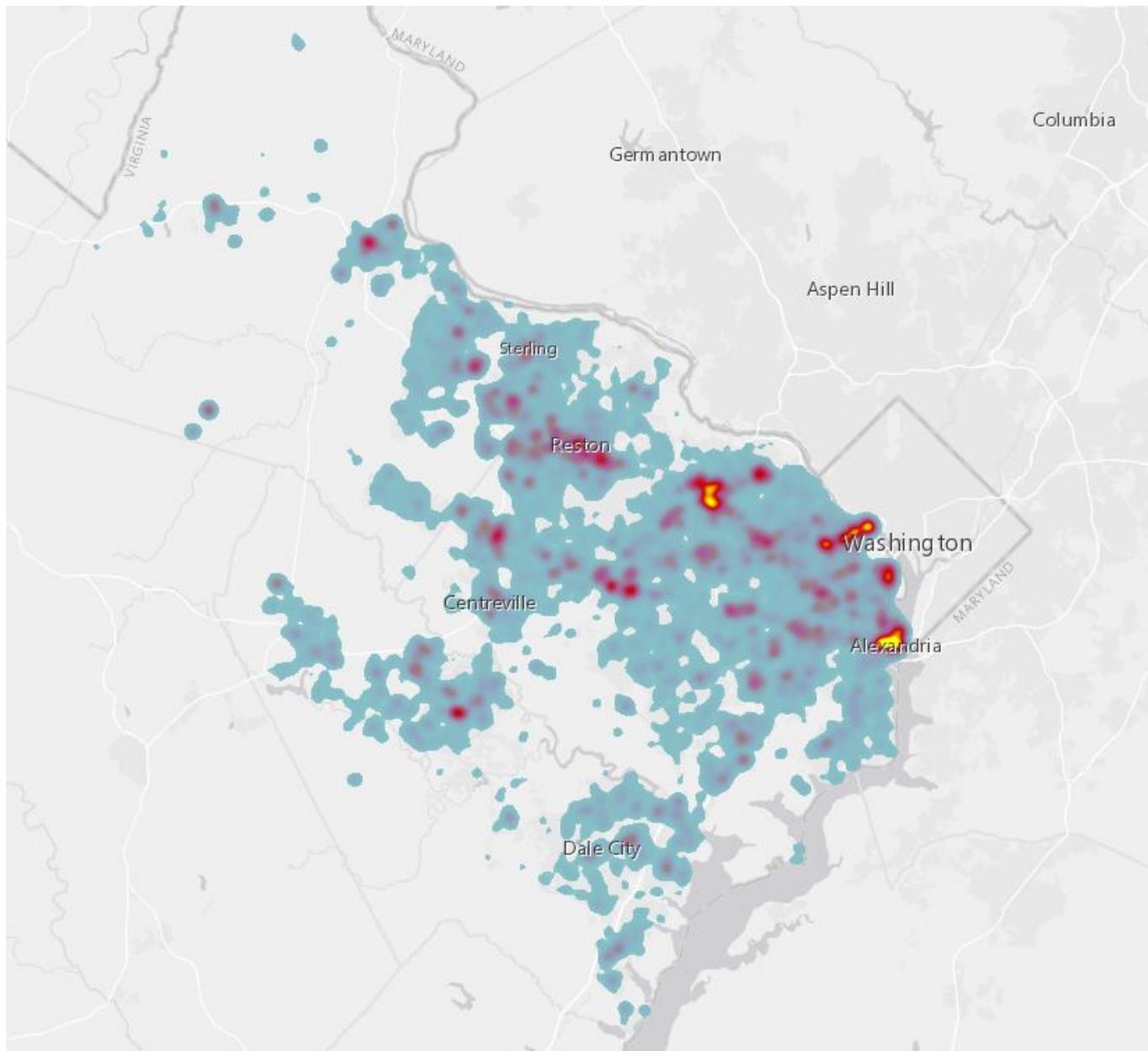
Industry Cluster	Economic Development Position in Region	Contribution of Entrepreneurship	Data Analysis						
			2017 Employment	2017 Location Quotient	Regional 2007-2017 Percentage Job Growth	U.S. 2007-2017 Percentage Job Growth	Net Job Growth, All Companies, 2007-2017	Net Job Growth, Startups, 2007-2017	Share Start-ups of All Net Job Growth, 2007-2017
Agriculture & Food Processing	Emerging Strength	Very Significant	3,973	0.15	38.6%	10.7%	1,106	1271	115%
Business Services	Specialized/Growing	Very Significant	112,589	1.71	5.4%	9.1%	5,812	24642	424%
Energy, Natural Resources, & Finished Products	Declining	Very Significant	6,588	0.31	-5.1%	-13.3%	-351	1127	>100%
Engineering, R&D, Testing & Technical Services	Specialized/Declining	Very Significant	41,025	2.79	-13.6%	6.5%	-6,434	4982	>100%
Financial & Insurance Services	Emerging Strength	Very Significant	27,974	1.04	10.4%	-4.1%	2,626	6164	235%
Health Care Services	Emerging Opportunity	Modest	19,361	0.46	13.5%	12.5%	2,310	1286	56%
Information Technology & Communications Services	Specialized/Growing	Significant	123,862	5.03	14.9%	50.8%	16,027	12732	79%
Life Sciences	Declining	Very Significant	6,041	0.48	-26.5%	9.7%	-2,174	1815	>100%
Manufacturing	Declining	Very Significant	11,866	0.18	-21.7%	-13.5%	-3,296	2369	>100%
Ship Building, Aerospace, & Defense	Emerging Strength	Significant	1,658	0.27	224.5%	-7.7%	1,147	917	80%
Transportation, Distribution and Logistics	Emerging Strength	Very Significant	38,296	0.66	11.9%	8.7%	4,078	9457	232%

Geographic Distribution of Traded Sector Startup Activity in Region

High Regional
Startup Activity
Levels



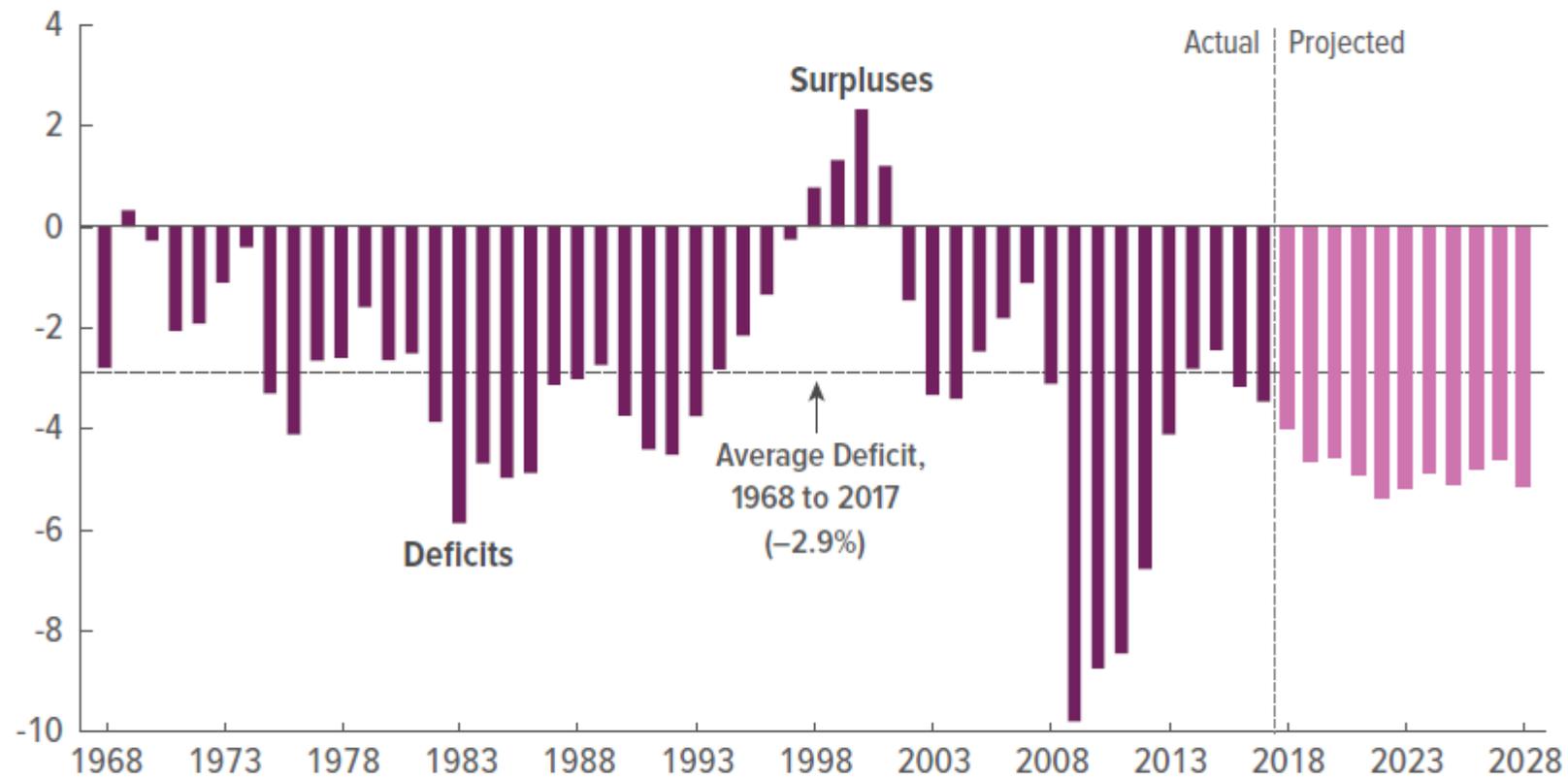
Low Regional
Startup Activity
Levels



Policy changes have resulted in growing deficits despite the economic expansion. The 2018 deficit (\$779B) is up \$113B (17%) from 2017.

Total Deficits or Surpluses

Percentage of Gross Domestic Product

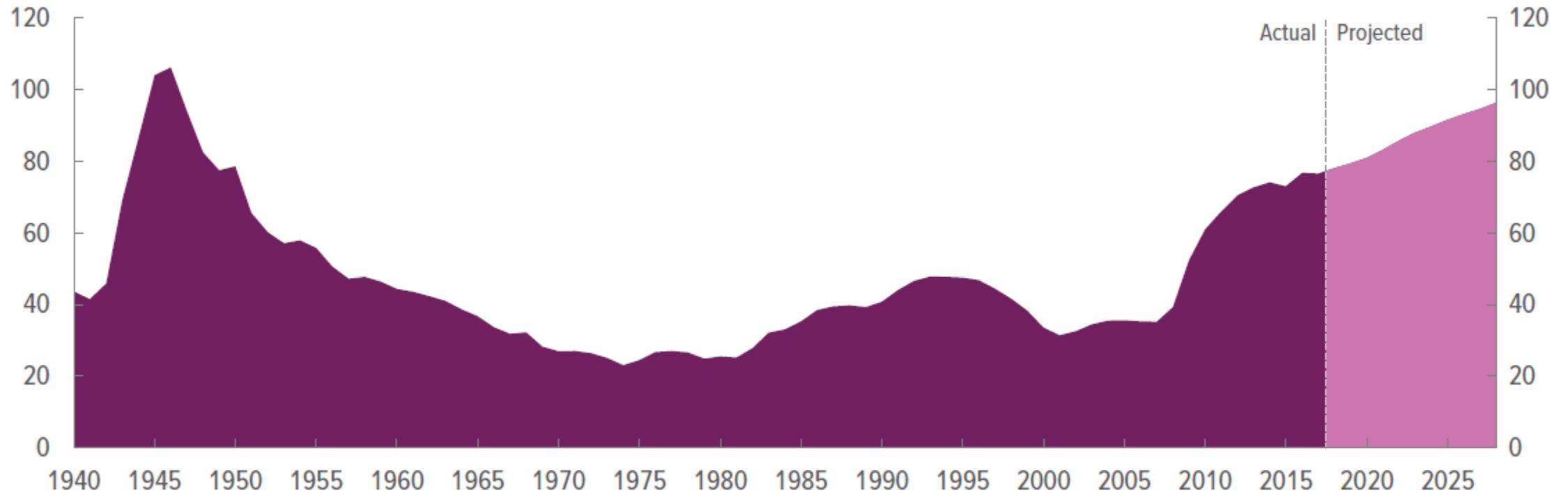


Source: Congressional Budget Office.

In next 10 years, U.S. debt (\$21 trillion) projected to increase from 76.5% of GDP in 2017 to 96.2%—a first for a non-war period. Annual budget outlays on interest payments will triple by 2028 (currently 14% of budget).

Federal Debt Held by the Public

Percentage of Gross Domestic Product



Source: Congressional Budget Office.

How do these macro trends relate to Northern Virginia's startup ecosystem?

- Unrealistic to think that structural problems caused by increasing debt will not negatively impact government contracting sector in the next 10 years.
- Northern Virginia has a strong entrepreneurial ecosystem for IT, cybersecurity, and engineering services in the government contracting space, as indicated in the following slides.
- However, if its \$38B customer (2016 estimate of federal procurement from Northern Virginia companies) diminishes over the next 10 years, what does this mean for Northern Virginia's startup ecosystem?
- How can GO Virginia strengthen the startup ecosystems for commercially-focused IT and engineering technology startup activity?

Initial Analysis of Broader Innovation Ecosystem Activity Innovation Ecosystem Activities

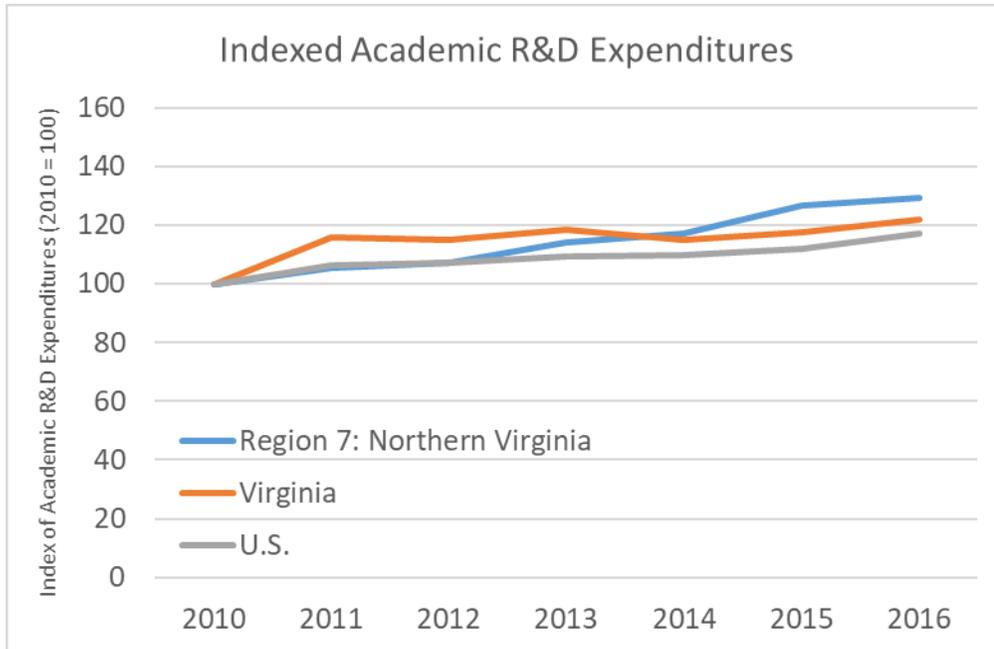
Key Measures:

- R&D and Commercialization
- Patent Activity of Inventors Residing in Region
- Venture Capital
- Federal Small Business Innovation Research Awards
- SBA Loan Activity

George Mason University's research base is expanding, though historically weighted towards social sciences, which is characterized by less tech transfer activity. GMU's R&D profile is changing.

Academic R&D Expenditures (\$M), 2010-2016

Region 7: Northern Virginia	2010	2011	2012	2013	2014	2015	2016	Total
George Mason University	\$84.1	\$88.1	\$90.2	\$95.9	\$98.7	\$106.4	\$108.9	\$672.3



Academic R&D Expenditures: Top 5 Disciplines, 2010-16

Field	R&D Expenditures (\$M)	% of Total
Economics	\$87.86	13.1%
Computer and Information Sciences	\$74.42	11.1%
Health Sciences	\$56.99	8.5%
Education	\$46.00	6.8%
Psychology	\$42.07	6.3%

- But federal lab R&D funding stands out – though not growing

R&D Expenditures at Federally Funded R&D Centers (Millions)

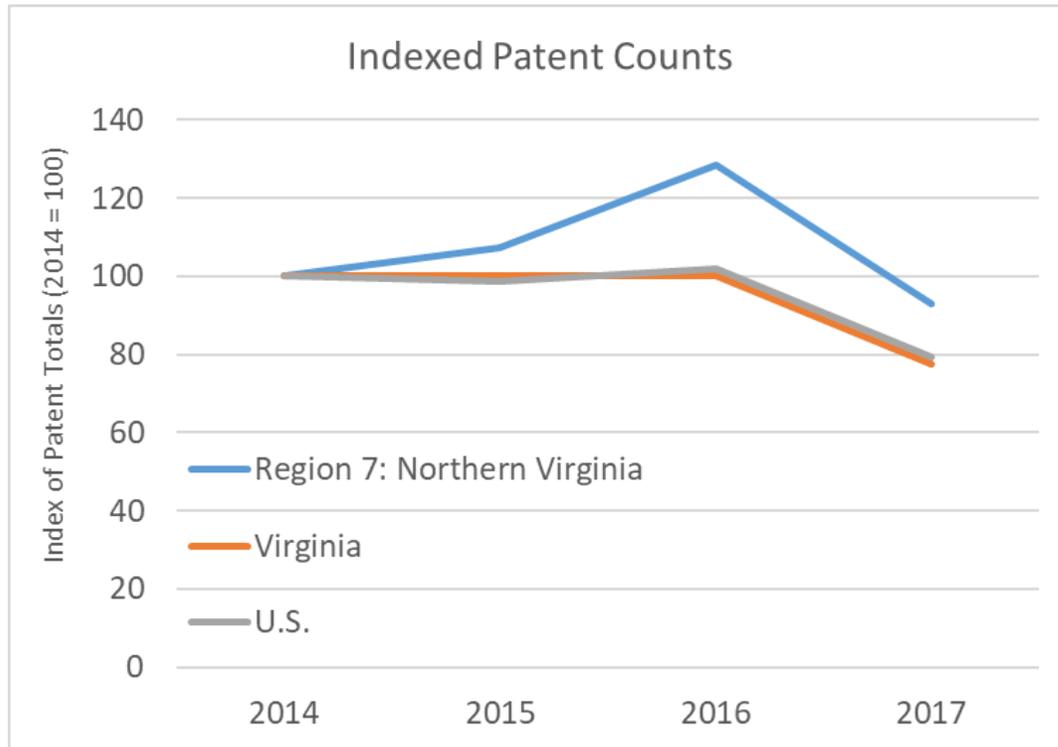
Region	2010	2011	2012	2013	2014	2015	Total
National Security Engineering Center		\$941.2	\$946.7	\$928.6	\$885.4	\$919.4	\$4,621.4
Judiciary Engineering and Modernization Center	\$1,370.7	\$1,425.0	\$5.3	\$6.4	\$2.3	\$4.3	\$2,814.1
Center for Enterprise Modernization	\$10.1	\$187.8	\$226.5	\$202.3	\$158.1	\$145.4	\$930.3
Systems and Analyses Center	\$156.0	\$156.2	\$149.2	\$143.0	\$145.2	\$157.6	\$907.2
Center for Advanced Aviation System Development	\$7.6	\$165.6	\$159.3	\$146.9	\$149.1	\$155.7	\$784.2
Center for Naval Analyses	\$109.1	\$85.2	\$91.6	\$86.1	\$80.3	\$80.4	\$532.6
Homeland Security Systems Engineering and Development Institute	\$1.3	\$85.2	\$77.2	\$75.5	\$94.4	\$77.2	\$410.6
Center for Communications and Computing	\$71.9	\$72.6	\$62.6	\$51.5	\$63.2	\$56.5	\$378.3
Homeland Security Studies and Analysis Institute						\$7.8	\$7.8

Federal Lab R&D Expenditures

Considerable talent in the region actively creating new intellectual property, but highly concentrated in IT and cybersecurity

Total Patents, 2014-2017

Region 7: Northern Virginia	2014	2015	2016	2017	Total
Patent Counts	2,737	2,934	3,519	2,546	11,736



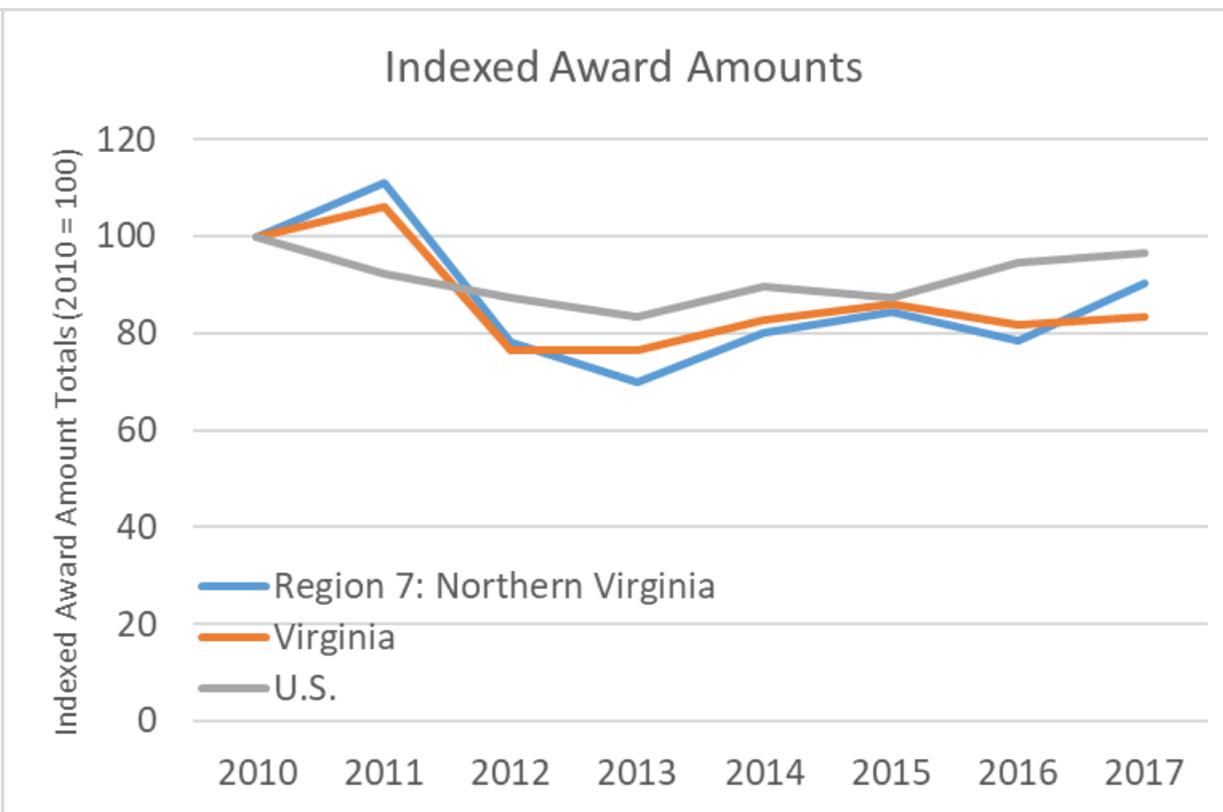
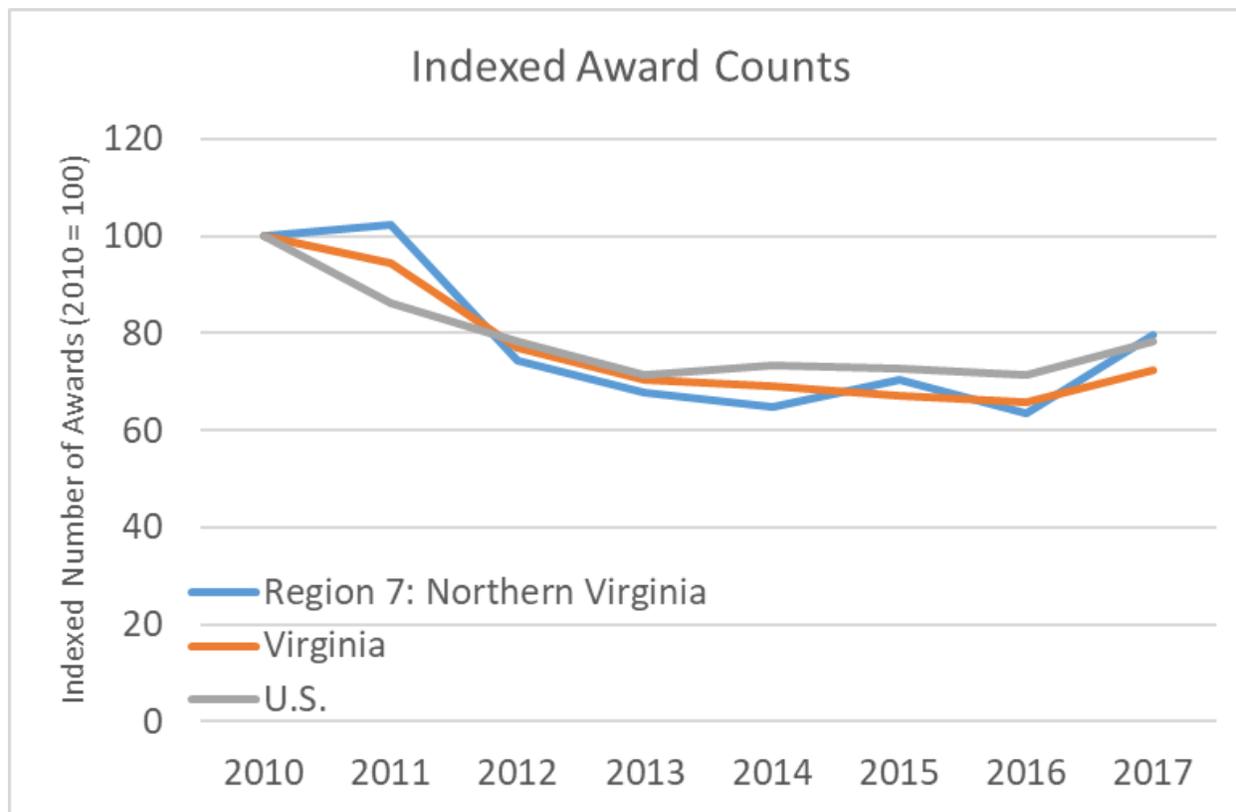
Top Patent Areas	# of Patents by Inventors, 2010-2017
Network architectures or network communication protocols for network security	698
Digital computing or data processing equipment or methods, specially adapted for specific functions	694
Electronic commerce	363
Security arrangements for protecting computers, components thereof, programs or data against unauthorized activity	327
Data processing systems specially adapted to administration and management purposes	254
User interface and data input devices	239
Network-specific arrangements or communication protocols supporting networked applications	228

Ranking of patent assignees, with at least one Virginia inventor, by number of patents awarded, 2010-2018

Assignee	# patents
U.S. Navy	516
IBM	504
Amazon Technologies	359
Spring Spectrum	228
Facebook	206
Time Warner Cable	204
Ofinno Technologies	197
ExxonMobile Research and Engineering	186
AOL	178
Verizon	175
CapitolOne	151
U.S. Postal Service	108
Sprint Communications	107
Google	96
Blackberry	95

Assignee	# patents
K2M	94
ABL IP Holding	90
Raytheon	85
Comcast	81
Bank of America	75
MicroStrategy	71
Alarm.com	71
Georgetown University	70
Accenture Global Services	67
MITRE Corp.	58
BAE Systems	57
Boeing	56
U.S. Army	53
George Mason University	52
Lockheed Martin	47

Northern Virginia companies are high performing in SBIR/STTR awards, 2010-2017



Region 7: Northern Virginia	2010	2011	2012	2013	2014	2015	2016	2017	Total
Award Counts	220	225	164	149	143	155	140	175	1371
Award Amounts (\$M)	\$80.01	\$88.77	\$62.61	\$56.03	\$64.22	\$67.63	\$62.82	\$72.33	\$554.42

Source: U.S. Small Business Administration, SBIR/STTR award database.

Top 15 SBIR/STTR award winners accounted for 58.2% of total Northern Virginia SBIR/STTR awards from 2010-2017 (245 total companies received 1,371 awards).

Company Awardee	Technology Focus	value (\$M)	# of awards
Progeny Systems	Engineering solutions	\$48.437	124
3 Phoenix	Tactical, sonar systems	\$36.562	32
Decisive Analytics	Data analytics	\$33.160	76
Adaptive Methods	Systems engineering	\$27.277	57
Aurora Flight Sciences	Autonomous aircraft	\$26.504	60
Fibertek	Laser, electro-optics	\$22.673	58
Trident Systems	Technology, RF solutions	\$20.716	35
Azure Summit Technology	Technology, RF solutions	\$16.123	33
Technical Data Analysis	Engineering, software	\$15.960	47
Metron	Scientific consulting	\$14.889	50
ISA Associates	Image science	\$14.125	28
Dzyne Technologies	Intelligent aircraft	\$13.559	17
ObjectVideo	Video intelligence	\$12.496	32
Shared Spectrum	Wireless technologies	\$10.291	21
Materials Modifications	Nanomaterials and coatings	\$10.132	36

Four Northern Virginia Exits ranked in the Top 15 regional SBIR/STTR performers from 2010-2017 (or until acquisition date)—two were venture-financed and have clear commercial market applications



Adaptive Methods
(\$27.3M SBIR/STTR)
Acquired by L3 for
undisclosed \$, 2017

Aurora Flight Sciences
(\$26.5M SBIR/STTR)
Acquired by Boeing for
undisclosed \$, 2017

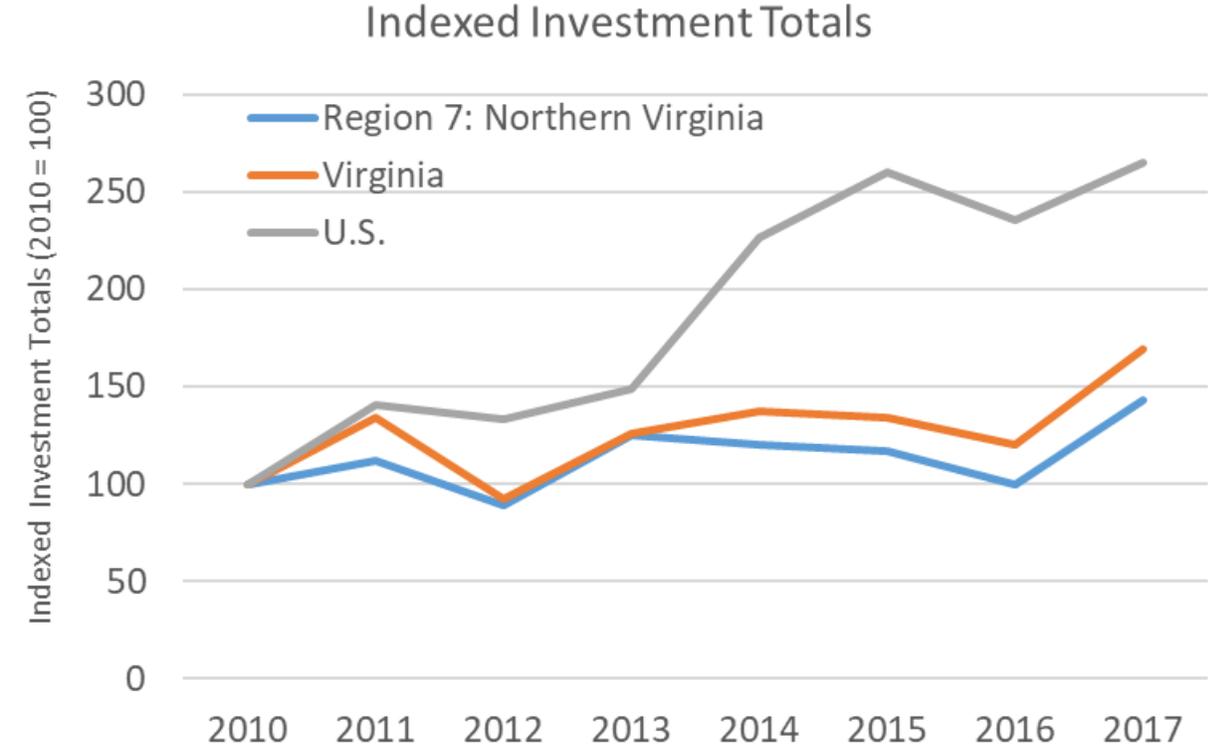
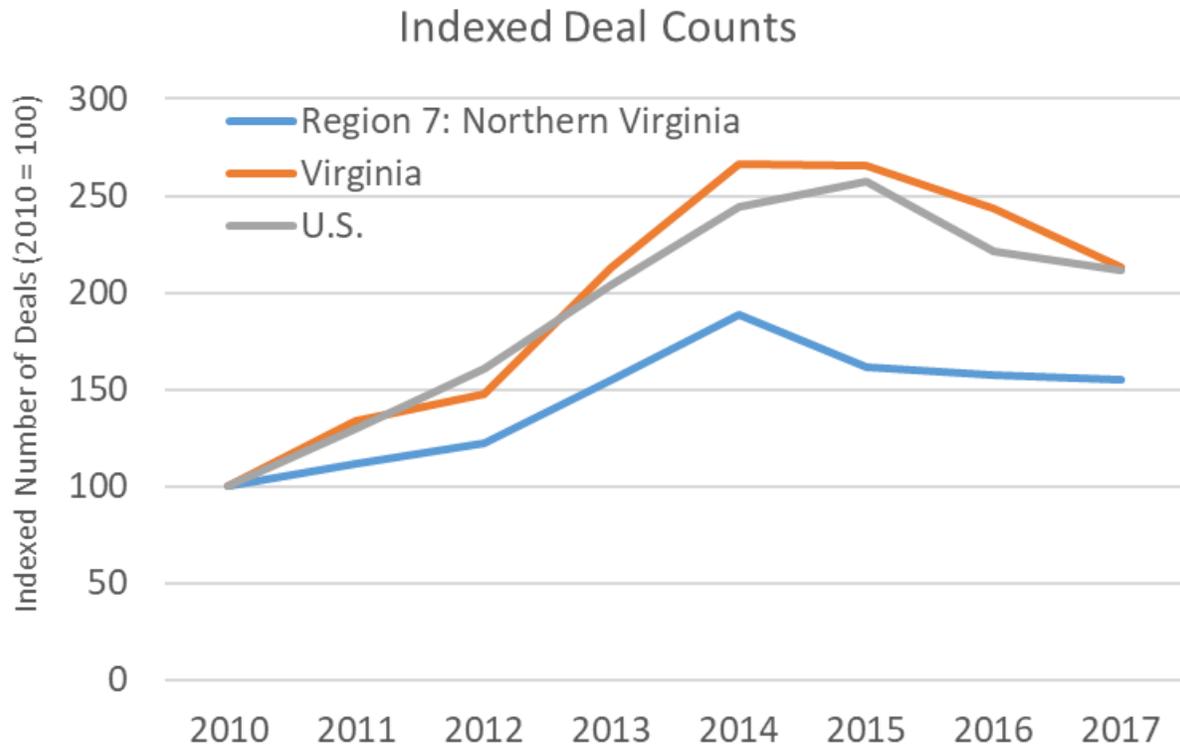


3 Phoenix (\$36.6M
SBIR/STTR)
Acquired by Ultra
Electronics for \$70M+,
2014

ObjectVideo (\$12.5M
SBIR/STTR)
Acquired by Alarm.com
for undisclosed \$, 2017



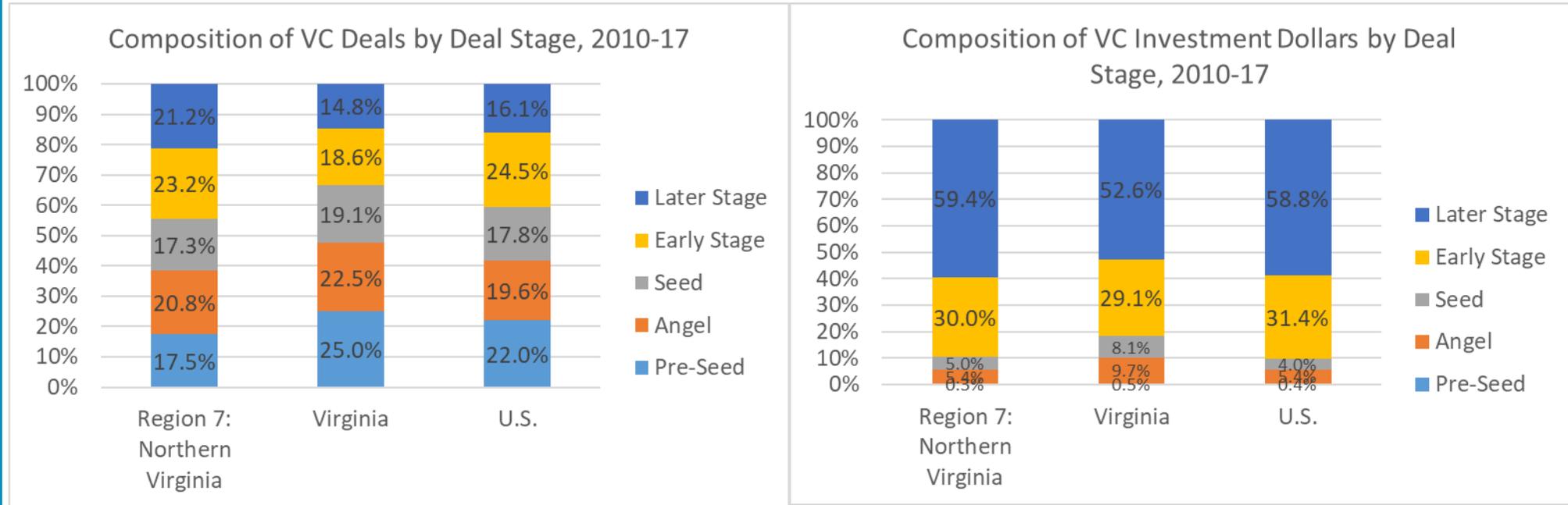
Northern Virginia technology companies are not pursuing/attracting VC as a source of early-stage risk capital.



Region 7: Northern Virginia	2010	2011	2012	2013	2014	2015	2016	2017	Total
Deal Counts	80	89	98	124	151	129	126	124	921
Investment Totals (\$M)	\$406.5	\$454.3	\$362.0	\$508.5	\$489.1	\$475.0	\$404.9	\$580.3	\$3,680.6

Venture Capital

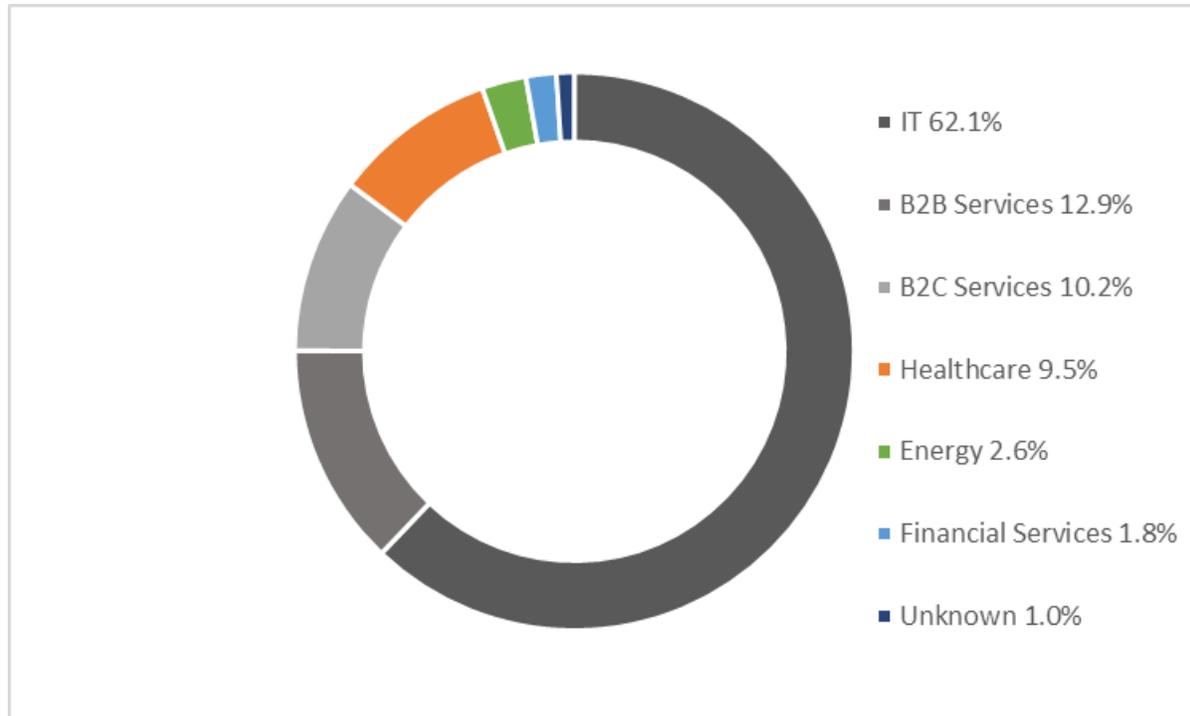
- Composition of deals by stage, 2010-17



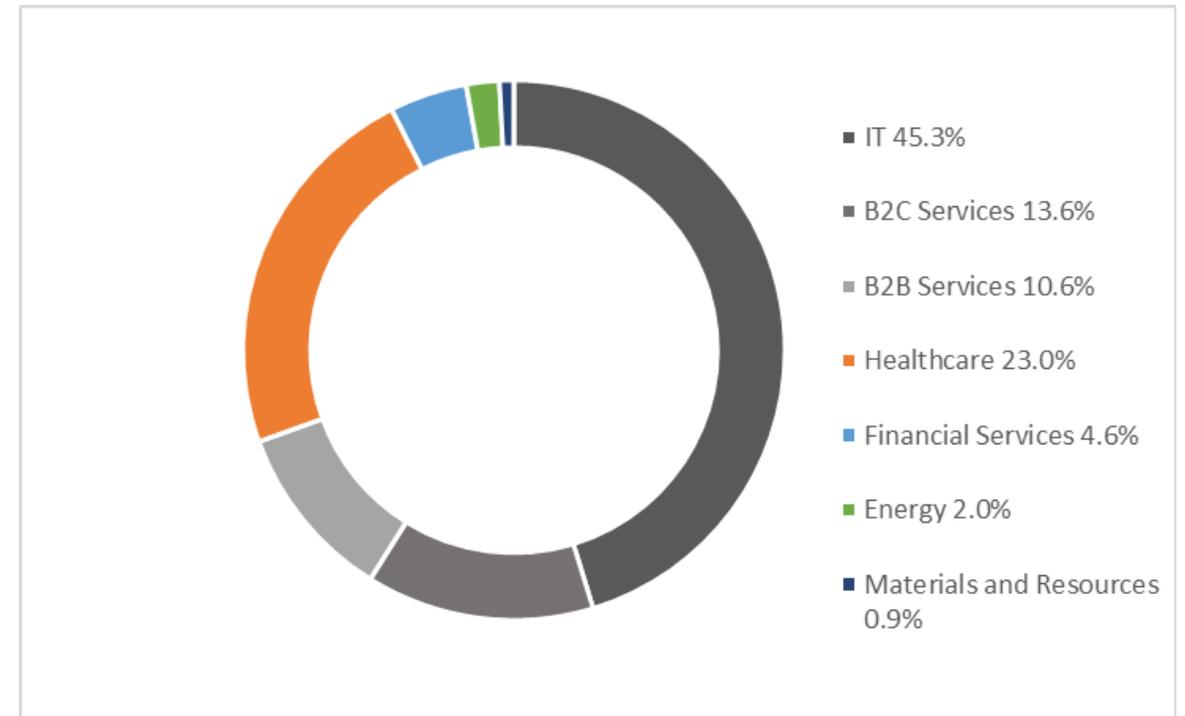
Region 7: Northern Virginia	Pre-Seed	Angel	Seed	Early Stage	Later Stage	Total
Deal Counts	161	192	159	214	195	921
Investment Totals (Millions)	\$10.1	\$198.6	\$182.3	\$1,102.3	\$2,187.2	\$3,680.6

85.2% of the VC dollars that Northern Virginia attracted from 2015-17 were IT-related sectors

Virginia VC Investment (\$) by Technology Sector, 2015-2017



U.S. VC Investment (\$) by Technology Sector, 2015-2017



- Leading companies receiving pre-seed, angel, or seed investments, 2010-17 totals

Companies Receiving Accelerator/Incubator, Angel, and Seed Investments, 2010-17

Company	Industry Cluster	Deal Count	Investment Total (Millions)
RTO Energy Trading	Business Services	2	\$14.39
MakeOffices	Business Services	2	\$14.00
InLoop	Business Services	4	\$13.80
Veco	Energy, Natural Resources, & Finished Products	1	\$11.40
Vemo Education	Financial & Insurance Services	3	\$10.90
Speek	Information Technology & Communications Services	4	\$8.25
Stay Smarter	Other	2	\$8.00
5G Dispensing Systems	Other	1	\$7.58
NS8	Information Technology & Communications Services	2	\$7.55
CargoSense	Transportation, Distribution and Logistics	1	\$7.29

Regional Use of SBA Loans

- **SBA 7(a) loans are the agency's primary program for financial assistance to small businesses**
 - Amounts: up to \$5M
 - SBA guarantees: 75% to 85%
 - Qualification: for-profit business, SBA size standards, demonstrate good credit/mgmt./ability to repay
 - Use of Proceeds: Startup costs, buying land/buildings/equipment, new construction, working capital, seasonal lines of credit.
 - Benefits: Flexible, longer terms, lower down payments, no prepayment penalties

Region 7: SBA 7(a) Loans and Loan Amounts, Cumulative Totals 2010-18*

Industry Clusters	Co's Receiving Loans	Total No. of Loans	Total Loan Amounts (\$)	% of Total Loan Amounts
Total, All Traded Sector Industries	874	1,050	\$371,424,300	100%
Agriculture & Food Processing	31	42	\$17,383,600	5%
Business Services	311	369	\$131,541,300	35%
Energy, Natural Resources, & Finished Products	9	10	\$3,797,800	1%
Engineering, R&D, Testing & Technical Services	88	107	\$30,190,800	8%
Financial & Insurance Services	25	31	\$13,966,700	4%
Health Care Services	2	2	\$733,000	0%
Information Technology & Communications Services	228	271	\$108,823,800	29%
Life Sciences	16	20	\$9,691,900	3%
Manufacturing	43	54	\$15,555,800	4%
Ship Building, Aerospace, & Defense	5	5	\$1,200,000	0%
Transportation, Distribution and Logistics	30	38	\$7,537,500	2%
All Other, Non-cluster Industries	86	101	\$31,002,100	8%

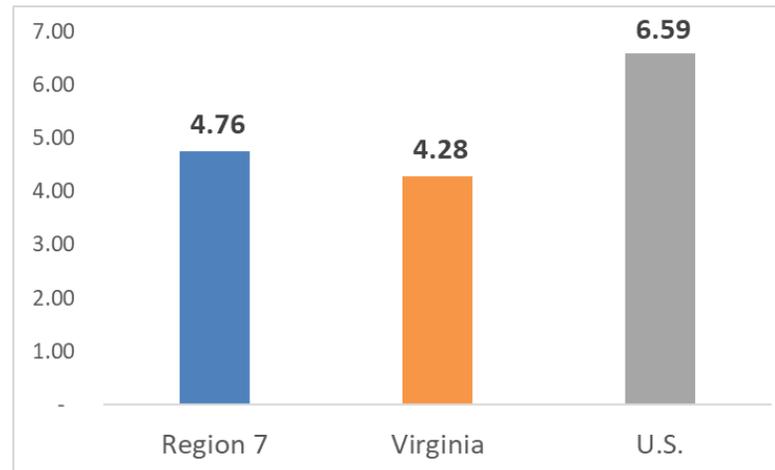
Source: TEconomy analysis of SBA loan data reports.

*Data for 2018 are through Q2.

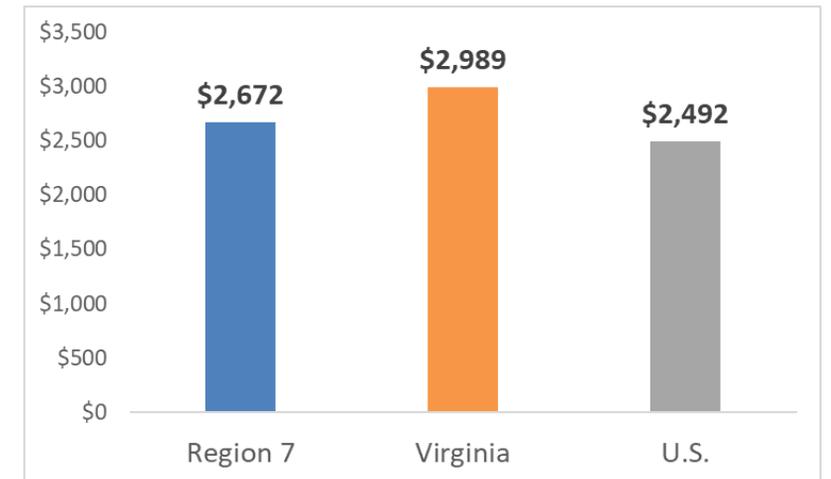
Regional Utilization of SBA Loans vs. State & U.S. Totals

- In 2017, regional companies approved for loan funding at a greater level relative to overall establishments compared with US, but lower than Virginia

SBA 7(a) Loan Counts, Traded Sector Companies Per 1,000 Establishments, 2017



SBA 7(a) Loan Amounts (\$), Traded Sector Companies Per Establishment, 2017



Appendix B: Competitive Benchmarking

Benchmarking: *Regions Selected and Comparative Measures*

- **Regions Selected:** TEconomy solicited and received input across the 9 GO Virginia regions on regions they benchmark themselves against, consider useful comparisons

- **Large Technology Hubs**

- Raleigh/Durham, NC
- Austin, TX
- Charlotte, NC

- **Medium-sized regions with urban core and multiple mid-tier research institutions**

- Birmingham, AL (UAB)
- Chattanooga, TN – medium-sized, minimal university presence
- Dayton, OH (Univ. of Dayton; Wright State Univ.)
- Durham, NC (Duke)
- Greenville, SC (Clemson Univ.)
- Nashville, TN – medium-sized, major research university
- Raleigh, NC (NC State)

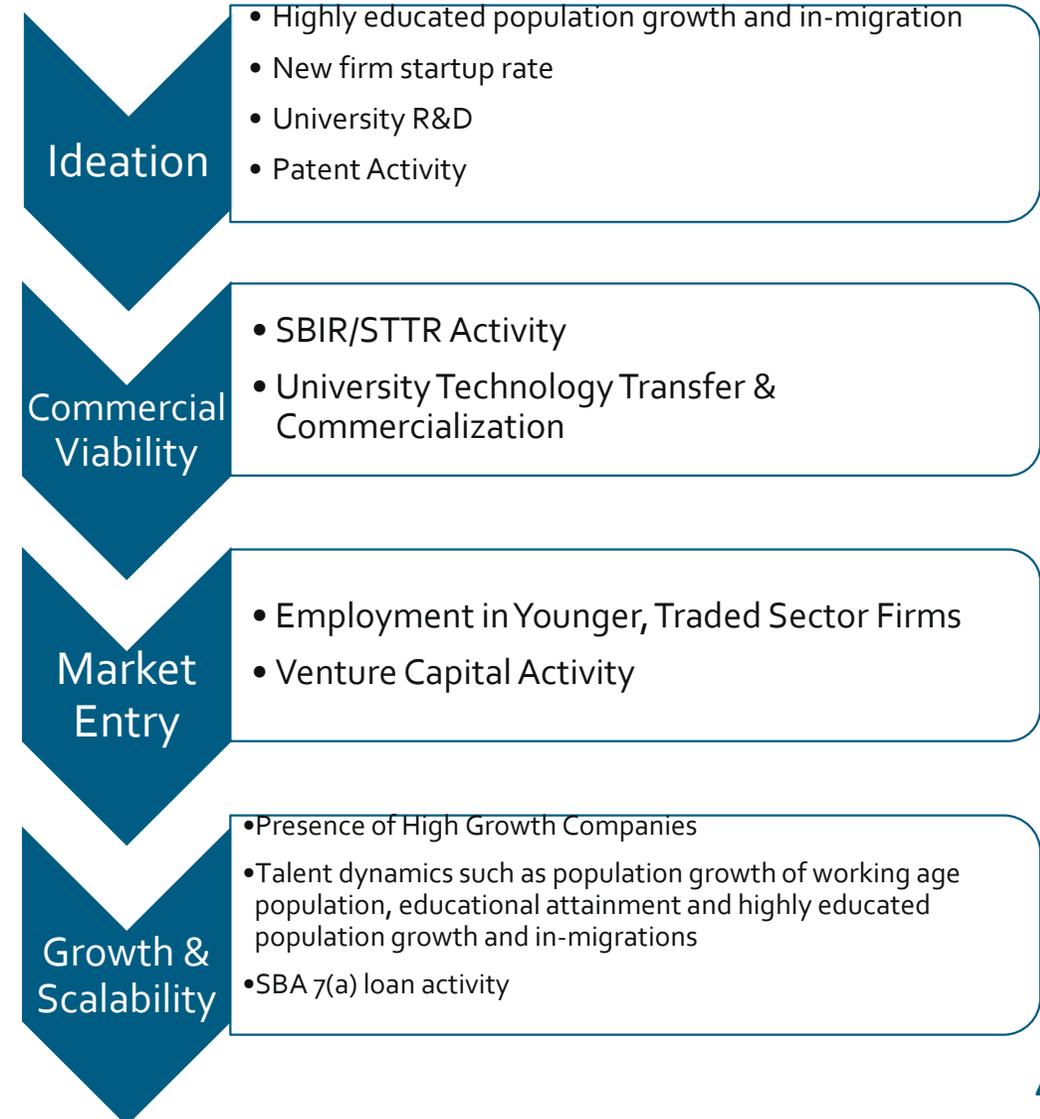
- **Rural regions with major research institutions**

- West Lafayette, IN (Purdue University)
- Gainesville, FL (Univ. of Florida)

- **Rural region without major research institutions (near Interstate and mfg.-oriented)**

- Greater Susquehanna, PA (MSA/Micro blend)
- Cookeville, TN (Micro) – rural, minimal university presence
- Jackson, TN (Micro) – rural, minimal university presence

- **Comparative Measures:** Organized across stages of entrepreneurial development



*Regional geographies are Metropolitan Statistical Areas (MSAs) if not otherwise specified above.

Ideation

Ecosystem Element	Measure	GO VA Region 7	VA	U.S.	Benchmarking Groups: Median Value			
					Large Tech Hubs	Mid-sized Regions	Rural with Major Research Anchor	Rural with No Major Research Anchor
New Firm Startup Rate	Rate of New Firm Formation as a Percent of All Firms, 2014	8%*	7%	8%	9%	7%	7%	5%
	Percentage Pt. Change, 2010-14	0.3	0.3	0.2	0.0	-0.1	0.4	-1.0
University R&D	University R&D Expenditures per Capita, 2016	\$44	\$174	\$222	\$863	\$370	\$2,800	\$62
	Percent Change in Total R&D Expenditures, 2010-16	29%	22%	17%	16%	15%	13%	-25%
Patenting (Incls. Industry & University)	Invented Patents per 1,000 Population, 2017	0.5	0.3	0.5	2.1	0.4	1.4	0.2
	Percent Change in Total Invented Patents, 2014-17	-28%	-33%	7%	16%	9%	20%	6%

Note:

- Large Tech Hubs: Raleigh/Durham, NC; Austin, TX; Charlotte, NC
- Mid-Sized Regions: Birmingham, AL; Chattanooga, TN; Dayton, OH; Durham, NC; Greenville, SC; Nashville, TN; Raleigh, NC
- Rural region with Major Research Anchor: West Lafayette, IN; Gainesville, FL
- Rural region without Major Research Anchor: Greater Susquehanna, PA; Cookeville, TN; Jackson, TN

Commercial Viability

Ecosystem Element	Measure	GO VA Region 7	VA	U.S.	Benchmarking Groups: Median Value			
					Large Tech Hubs	Mid-sized Regions	Rural with Major Research Anchor	Rural with No Major Research Anchor
SBIR/STTR Awards	SBIR, STTR Award Funding per Capita, Avg. 2014-17	\$27	\$15	\$8	\$17	\$5	\$30	\$0.30
	SBIR, STTR % Pt. Change in Share of Award Funding, Avg. 2010-13 to 2014-17	-0.29	-0.56	-	0.09	0.03	-0.04	0.00
	Number of Phase 1 Awards, 2010-2017	897	1,796	17,802	486	44	119	2
	Number of Phase 2 Awards, 2010-2017	474	935	10,002	235	33	49	0
University Technology Transfer & Commercialization	Avg. Annual Univ. Start-ups, 2014-16	1*	17	911	28	5	21	-
	Avg. Startups Formed per \$10M Univ. Research, 2014-16	0.10*	0.15	0.16	0.13	0.10	0.36	-
	Avg. Licenses/Options Executed per \$10M Univ. Research, 2014-16	0.20*	1.12	1.14	1.54	1.03	2.87	-

Note:

*For GMU tech transfer, relied on data reported to SCHEV (not AUTM) for most recent two years FY 2017 and FY 2018.

Market Entry

Ecosystem Element	Measure	GO VA Region 7	VA	U.S.	Benchmarking Groups: Median Value			
					Large Tech Hubs	Mid-sized Regions	Rural with Major Research Anchor	Rural with No Major Research Anchor
Employment in Younger, Traded Sector Firms	Share of Employment in Traded Sector Firms Ages 0-5, 2017 Q2	8%	7%	8%	8%	6%	7%	3%
	Avg. Share of Employment Growth in Firms Ages 0-5, 2013-2017 Q2	62%	52%	46%	36%	34%	42%	30%
Venture Capital Investments	VC Investments, 2014-17	\$2.0 B	\$2.6 B	\$308 B	\$2.3 B	\$127 M	\$66 M	\$0.2 M
	VC Investments per Capita, 2014-17	\$793	\$315	\$954	\$1,221	\$164	\$255	\$1
	Change in VC Investment, 2010-13 to 2014-17	13%	24%	89%	42%	86%	-13%	2000%
	VC Deals, 2014-17	530	1,068	54,030	565	81	74	3
	VC Deals per 100,000 population, 2014-17	22	13	17	31	13	30	2
	Change in VC Deals, 2010-13 to 2014-17	36%	67%	58%	67%	49%	135%	125%
	Share of VC Investments in Angel + Seed + Early Stages, 2014-17	49%	51%	41%	36%	79%	65%	100%
	Share of VC Deals in Angel + Seed + Early Stages, 2014-17	83%	81%	88%	85%	84%	91%	100%

Growth & Scalability

Ecosystem Element	Measure	GO VA Region 7	VA	U.S.	Benchmarking Groups: Median Value			
					Large Tech Hubs	Mid-sized Regions	Rural with Major Research Anchor	Rural with No Major Research Anchor
SBA 7(a) Loans	Avg. SBA 7(a) Loans, per 100,000 population, 2010-2017	4.7	2.9	4.7	3.6	2.7	2.0	3.2
	Change in SBA 7(a) Loans, 2010-2017	5%	11%	22%	55%	80%	-17%	-20%
	Avg. SBA 7(a) Loan Value, per Capita, 2010-2017	\$13	\$9	\$17	\$18	\$12	\$10	\$20
	Change in SBA 7(a) Loan Value, 2010-2017	120%	214%	82%	149%	120%	693%	48%
Presence of High-Growth Companies	Number of Companies on the Inc. 5000 List of Fastest Growing US Companies, 2018	220	297	-	57	13	3	1
	Change in Companies in Inc. 5000, 2010-18	-4%	2%	-	15%	13%	83%	-50%

Cross-Cutting Ecosystem Element: Talent Dynamics

Ecosystem Element	Measure	GO VA Region 7	VA	U.S.	Benchmarking Groups: Median Value			
					Large Tech Hubs	Mid-sized Regions	Rural with Major Research Anchor	Rural with No Major Research Anchor
Growth in Working Age Population	Growth in Total Working Age Population, 25-64—2012-2017	3%	1%	3%	9%	5%	2%	-2%
	Growth in Young Working Age Population, 25-34—2012-2017	-4%	3%	7%	11%	7%	6%	4%
Educational Attainment	Share of Population Ages 25-64 with a Bachelor's Degree or Higher, 2017	42%	28%	23%	31%	23%	21%	15%
	Growth in Highly Educated Workforce (BA+), (25-64, working age) — 2012-2017	7%	10%	12%	26%	17%	16%	6%
Highly Educated Migration	Net Migration of Highly Educated Workers (BA+), 2012-17	10,618	7,520	154,411	45,424	2,279	-9,684	-1,402
	Foreign In-Migration (BA+), 2010-17	97,078	151,627	3,933,494	38,243	8,782	8,423	587

Competitive Benchmarking Assessment

- Northern Virginia has a mixed performance compared to other large tech areas, despite its significant assets of highly educated workforce and tech-based industries.



Overall Assessment				
Well Performing Measures	<ul style="list-style-type: none"> Growth in University R&D Change in Business Formation 	<ul style="list-style-type: none"> SBIR/STTR Activity 	<ul style="list-style-type: none"> Growth of Jobs in Younger, Traded Firms 	<ul style="list-style-type: none"> Inc. 5000 High-Growth Companies
On Par Measures	<ul style="list-style-type: none"> Rate of New Business Formation 		<ul style="list-style-type: none"> Share of startup employment in all traded sector industries Share of Angel, Seed and Early Stage VC Investment 	<ul style="list-style-type: none"> SBA 7(a) loan activity slightly higher, but loan value slightly lower – and growth behind other large tech hubs
Lagging Measures	<ul style="list-style-type: none"> Level of University R&D Expenditures Patent activity and growth Lagging growth rates of highly educated workforce and net migration 	<ul style="list-style-type: none"> Limited university technology transfer activity 	<ul style="list-style-type: none"> VC Investment Activity & Growth 	<ul style="list-style-type: none"> Lagging growth rates of working age population, highly educated workforce and net in-migration of highly educated workers

Note: Assessment based on comparison to median values for large technology regions (Austin, Raleigh-Durham and Charlotte)



Appendix C: Benchmark Case Study Profiles

Benchmark Case Studies: Wide Number of Tools for Entrepreneurial Development



Typical Entrepreneurial Assistance Service Tools

<p>Tool-Kit Components</p>	<ul style="list-style-type: none"> • Lean startup bootcamps/pre-accelerator preparation • Mentoring by an EIR/venture advisor • Pitch/Business competitions • University entrepreneurship centers • University technology commercialization scouting 	<ul style="list-style-type: none"> • Accelerators/venture development organizations/incubators • NSF iCorps • Mentoring by EIRs with understanding of specific markets and technologies • Incubator, co-working, maker-spaces 	<ul style="list-style-type: none"> • Mentoring by EIR with serial startup experience • Second stage incubators, research parks, multi-tenant specialized lab facilities 	<ul style="list-style-type: none"> • Growth services involving talent recruitment and development, networking in domain areas and business functions, export assistance • Mentoring by seasoned business executive who grew companies 20x
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Typical Risk Capital Catalysts Tools

<p>Tool-Kit Components</p>	<ul style="list-style-type: none"> • Commercialization/Technology Transfer Funds • Pitch competition micro-investments 	<ul style="list-style-type: none"> • Proof-of-Concept Funds • SBIR/STTR Matching Grants • Accelerator and Pre-Seed Funding • Refundable R&D and Technology Investment Tax Credits 	<ul style="list-style-type: none"> • Angel Matching/Due Diligence Funds • Angel Investment Tax Credits • Seed Matching Funds 	<ul style="list-style-type: none"> • Fund of Fund Investments (multiple ways to generate funding)
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Innovation and Entrepreneurial Development Ecosystem Components



Benchmark Communities			
Austin, TX	<p>← IC² Institute – mentorship, networking, Austin Technology Incubator →</p> <p>UT Kelleher Entrepreneurial Center UT School of Engineering Innovation Center</p>		<p>← South by Southwest Conference & Festivals →</p>
Birmingham, AL	<p>← Alabama Drug Discovery Alliance →</p> <p>Velocity Accelerator</p>	Innovation Depot	<p>Focus on IT training: Covalence IT coding boot camp; Innovate Birmingham efforts in IT training for under-employed and unemployed young adults</p>
Charlotte, NC	<p>UNCC 49er Student Foundry</p> <p>← Network of accelerators (fintech, cleantech, NC Idea →</p> <p>Charlotte Venture Challenge</p>	<p>UNCC NSF i-Corps Site</p> <p>Packard Place</p>	<p>Innovate Charlotte regional assessments on needs</p>
Chattanooga, TN	<p>← CO.LAB – mentorship, networking, accelerators, connection to capital →</p> <p>← CO.Starters →</p> <p>← CO.LAB’s Gig Tank, Consumer Goods Accelerators, etc. →</p>		<p>Crowd-sourced financing platforms, such as Kiva; Chattanooga Renaissance Fund (seed fund); and Lamp Post Group (early-stage VC)</p>
Dayton, OH	<p>Wright Brothers Institute (commercialization intermediary)</p>	<p>The Entrepreneurial Center accelerator program</p>	<p>The Entrepreneurial Center mentoring services</p> <p>Accelerant Seed Fund</p>
Gainesville, FL	<p>UF Entrepreneurship & Innovation Center</p>	<p>← Sid Martin Biotech Incubator & Innovation Hub Incubator →</p> <p>Florida Angel Nexus</p>	<p>← Innovation Square →</p> <p>Florida Opportunity Fund</p> <p>StartupGNV networking events</p>

Innovation and Entrepreneurial Development Ecosystem Components



Benchmark Communities	
Greenville, SC	← NEXT program of Greenville Chamber – accelerator, mentoring, incubator and makerspace → CU-International Center for Automotive Research
Nashville, TN	Vanderbilt Wondry ← Vanderbilt NSF i-Corps ← Bunker Labs – Launch Lab, Veterans-in-Residence program, CEOs Circle → ← Nashville Entrepreneurial Center – mentoring, Pre-Flight, In-Flight, Music & Healthcare Accelerators →
Raleigh-Durham, NC	← Active student bootcamps/pitch competitions/incubation → NC State NSF i-Corps Site ← Research Triangle Park, Centennial Campus, HQ coworking, American Underground & Biolabs → ← Active university alumni angel networks at Duke, NC State & UNC → NC State EIR to Scout for Technologies PoC Funds at NC State, UNC & Duke ← Duke collaboration with privately managed accelerator and incubators → ← NC Biotech Center → UNC Carolina Research Ventures \$10 m “Seed” Fund
Susquehanna, PA	← Rural Business Innovation network of incubators → College student internship funding Micro-startup grants from Rural Business Innovation ← Keysone Innovation Zone Transferable Tax Credits for Young Firm Revenue Growth →
West Lafayette, IN	← Purdue Research Park & Purdue Discovery Park District: Incubators, Multi-tenant facilities, Mixed-Use placemaking → ← Purdue Foundry with EIR mentors → Trask Fund for applied research and PoC Elevate Purdue Foundry “pre-seed” Fund Ag-Celerator “pre-seed” Fund \$12 m Foundry Investment “seed” Fund

Benchmark Case Study: Austin, TX

Regional Context:	<ul style="list-style-type: none">• A major technology hub with one research anchor that until recently was not aggressive on tech transfer/startups and had no medical school• Chamber of Commerce drove progress where government was passive or lagged• Success at attracting semiconductor consortia in 1980s led to increasing ties to Silicon Valley and its investors• Unexpected success of Dell Computer in 1980s/1990s created local wealth and management talent, all used in startup formation
Key Tools:	<ul style="list-style-type: none">• IC2. Institute started creating entrepreneurial momentum even in a period when university itself lagged• Austin Technology Incubator. Probably the most important outcome of IC2. Industry verticals aligned with Chamber targets.• Dell Medical School. Chamber succeeded in lobbying state for new med school at UT Austin, and Travis County matched with local tax levy• Innovation District. Next logical step after medical school is an integrated medical district, now under way• SXSW. Once a music festival, it deliberately broadened to add film and software/interactive, creating additional ties to coastal media & investors• Kelleher Center at UT McCombs School. Finally active in entrepreneurship, UT Austin now has a campus hub in the business school• Cockrell School of Engineering Innovation Center offers advice and training to faculty and staff, provides small startup grants, and hosts competitions, among other activities.
Successes:	<ul style="list-style-type: none">• Chamber has adopted Innovate Austin initiative, and names annual 'A-list' of emerging, growth, and accelerator-stage ventures• Regional Council of Governments CEDS has unusually sophisticated section on entrepreneurship and growth acceleration, recognizing importance of both launch and expansion• ATI itself claims to have helped clients raise \$890 million in capital, cumulatively, \$200 million in 2016 alone to 19 companies• Across entire region, Chamber claims \$869 million in capital to 123 deals in 2016
Challenges:	<ul style="list-style-type: none">• Growing a full, research-oriented biomedical capacity has only just begun and remains a major challenge• Withering of semiconductor initiatives leaves status of J.J. Pickle Research Campus uncertain, isolated by expressway from main campus
Best Practice Lessons:	<ul style="list-style-type: none">• Austin is the pre-eminent example of successfully mixing arts and technology into a single message on creative economy• SXSW has been as impactful as any high-tech initiative, and made Austin a platform for startups nationally, as well as exposing local startups to the national audience• There are few other mid-sized metros with such close ties to the centers of music and film (LA) and tech (NY and San Francisco)

Benchmark Case Study: Birmingham, AL

Regional Context:

- Mid-sized region with research anchors, including University of Alabama Birmingham (\$500+ m annually) and Southern Research Institute (~\$70 m annually in contract research funding).
- Research anchor focus is strongly on life sciences.
- Challenge of having to reinvent itself from being a steel-oriented economy (the “Pittsburgh of the South”) to an innovation and knowledge hub.

Key Tools:

- **Applied and translational research focus:** Alabama Drug Discovery Alliance, a collaboration of SR and UAB, leverages significant drug discovery and development research and shared use facilities and moves new therapeutic leads through a structured process of assay development, high-throughput drug screening, lead identification and development, pre-clinical testing and early clinical trials.
- **Innovation Depot**, a 140,000 sq. ft. incubator and co-location space, making it one of the largest in the nation. It offers range of space options, including wet lab. The Innovation Depot is far more than a technology incubator, but a home for a variety of entrepreneurial and talent initiatives in collaboration with community stakeholders.
- **Velocity**, a relatively new accelerator housed at Innovation Depot, with ability to invest \$50,000 in seed funding for each selected startup company.
- **IT workforce development** – Multiple efforts in place at different levels for IT coding/software development bootcamps targeting undergraduates and under-employed/unemployed young adults.
- **Networking activities:** Tech Birmingham programs include a monthly TechTuesday speaker series, member only networking socials, broader information sharing events, and Keep It Local to create opportunities for local companies to do more business together in IT products and services, among other efforts.

Successes:

- Innovation Depot reports 112 companies assisted with 1,064 jobs and \$155 million in sales revenue. Largely tech-oriented companies, but some life sciences.
- Establishing networks and connections with other communities to generate investor interest and entrepreneurial teams, including New York and Israel
- Many of its graduates are now serving as tenants for a larger innovation district development in Birmingham
- Alabama Drug Discovery Alliance in early 2018 had 19 drugs in the development pipeline, leveraging major drug discovery programs in emerging infectious diseases, cystic fibrosis and cancer, engaging major biopharmaceutical companies.

Challenges:

- Advancing broader access to capital across stages of investment
- Generating life sciences startups from research anchors

Best Practice Lessons:

- Role of entrepreneurial anchor in creating focus and branding on innovation and entrepreneurship
- Advancing a single umbrella for delivery of technology transfer, commercialization and entrepreneurial services
- Embedding talent and workforce initiatives with innovation and entrepreneurial anchor activities

Benchmark Case Study: Charlotte, NC

Regional Context:	<ul style="list-style-type: none">• Fast growing technology hub with smaller research anchors• Leveraging position in banking center to generate a rising entrepreneurial community.
Key Tools:	<ul style="list-style-type: none">• Innovate Charlotte (formerly Charlotte Regional Fund for Entrepreneurship): Established through the 2012 regional plan for “Prosperity for Greater Charlotte,” and funded through the region’s \$2.5 billion community foundation. It was envisioned as a grant funding mechanism to support local non-profits to advance entrepreneurial culture, ecosystem connections, risk capital availability and technical skills. Over the years has taken a more pro-active approach in providing entrepreneurial assessments of the region, holding ideation workshops and recommending specific activities.• Packard Place: A redeveloped large auto showroom/building that has been transformed into an entrepreneurial hub housing multiple accelerators (see below) as well as offering fellowships to new startup founders and co-working space.• Network of accelerators: Includes one in clean energy (Joules Accelerator), fintech (QC FinTech), and tech (RevTech Labs and NC IDEA)• Ventureprise: UNC Charlotte’s long-time affiliated incubator founded back in 1986. Long history of engaging entrepreneurial community, though in 2017 reconstituted with a stronger focus on student and faculty startups, with programs such as Ventureprise Launch NSF iCorps for university tech commercialization and 49er Foundry a student incubator. Also manages the NC IDEA offering a lean-startup program similar to its Ventureprise Launch for innovation-driven startups in the community.
Successes:	<ul style="list-style-type: none">• Packard Place reports results for its aggregate community of accelerators, coworking spaces, fellows, etc. as generating from 2010-2017, 500 new jobs and \$1 billion in venture capital raised.• Ventureprise reports over the 2008-2017 period supporting 46 new clients, with some notable successes such as CSi/Photograds, Verian Technologies, SecureEdge Networks and Saprex, which had successful exits or have moved into their own commercial facilities to accommodate substantial growth.
Challenges:	<ul style="list-style-type: none">• Long time period to grow university research anchors to match fast growth of overall entrepreneurial activities and offer a deeper driver of innovation.• Not doing well in growing new research park anchors to complement emergence of technology hub, including slow growth of campuses with Charlotte Research Institute and David H. Murdock Research Institute.
Best Practice Lessons:	<ul style="list-style-type: none">• Role of community foundation and community leaders in spurring entrepreneurial development.

Benchmark Case Study: Chattanooga, TN

Regional Context:	<ul style="list-style-type: none">• Mid-sized region with limited research anchor. [RYAN, CAN YOU ADD BENCHMARKING INDICATORS?]
Key Tools:	<ul style="list-style-type: none">• Company Lab (or CO.LAB) is a non-profit accelerator and one-stop shop for local entrepreneurs founded in 2008. CO.LAB has developed a range of programs and services for both local growth and high-growth companies at different stages of development, including: Way Finding to screen and guide entrepreneurs to services, CO.STARTERS a 9-week program that teaches lean startup methods for business startup; CO.LAB Accelerator, a mentor-driven program for high-growth potential startups; GIG Tank, an accelerator focused on ultra-high bandwidth business applications; Consumer Goods Accelerator, an accelerator focused on outdoor recreation and food/beverage sector.• CO.LAB connects companies to capital, like the Chattanooga Renaissance Fund, and Lamp Post Group focused on seed investments. CO.LAB has also joined the Kiva, crowd-sourced financing platform.• In 2015 a new intermediary organization formed, the Enterprise Center, to more broadly leverage the City's high broadband infrastructure to create a place that develops and tests many applications for urban needs.• Chattanooga foundations and business leaders have historically invested in downtown revitalization efforts, including the riverfront development. CO.LAB spun out of downtown revitalization and visioning exercise supported by local family foundations. Other investments and assets include Chattanooga's gigabit network (10 gbps metro-wide fiber optic network), UTC, the regional university in close proximity to downtown, and the rebranded Innovation District involved mixed use developments.
Successes:	<ul style="list-style-type: none">• Significant scale of activities by CO.LAB since its formation back in 2008, including 20+ cohorts and 700+ participants in CO.Starters, 83 companies graduated and \$7M+ capital raised from CO.LAB Accelerator, 58 companies graduated and \$29M+ capital raised for GIG Tank and 200 consultations a year from Way Finding.
Challenges:	<ul style="list-style-type: none">• Lack of capital is viewed as a key constraint to high-growth companies
Best Practice Lessons:	<ul style="list-style-type: none">• Demonstration of how to revitalize a community and its downtown through talent retention, placemaking, startup activity, and ecosystem building that supports both "local growth" and high-growth companies• Critical role of local foundations in catalyzing activities and combining placemaking, unique tech infrastructure development and entrepreneurial programming.

Benchmark Case Study: Dayton, OH

Regional Context:	<ul style="list-style-type: none">• Mid-sized region anchored by major federal research lab, Air Force Research Labs at Wright Patterson Air Force Base, and University of Dayton with its research institute generating more than \$100m in research activities highly aligned with ARL needs, plus Wright State University, with some research programs and an important talent driver for the region.• Challenge of moving beyond federal contract activity to drive new traded sector company growth.
Key Tools:	<ul style="list-style-type: none">• Wright Brothers Institute (WBI): A partnership intermediary to facilitate technology transfer from ARL, identify unmet technology needs, further commercialization through collaborative team efforts and engage small technology-based businesses to tap opportunities and partnerships.• The Entrepreneur Center (TEC): Serves as the delivery arm of entrepreneurial services supported by the Ohio Third Frontier and operates a traditional incubator with two sites in the region, which is now expanding into offering coworking space and an accelerator program. Also houses a site for WBI.
Successes:	<ul style="list-style-type: none">• Wright Brothers Institute reports supporting over 100 innovation-based projects annually, with typically \$3 million of commercialization activities and engaging over 1,000 small technology-oriented businesses.• While not among the top performing seed funds in Ohio, the Accelerant seed fund over 2007-2014 invested \$17 million, creating 2,995 jobs and retaining 1,274 jobs. This performance though ranks last of the six privately-managed regional seed funds supported with matching funding from Ohio Third Frontier – and since 2013 has received no additional state matching funds.
Challenges:	<ul style="list-style-type: none">• Creating more commercially focused technology-based companies.
Best Practice Lessons:	<ul style="list-style-type: none">• While advancing industry partnerships with federal labs can be effective, it does not always translate into new commercially-focused technology businesses.

Benchmark Case Study: Gainesville, FL

Regional Context:	<ul style="list-style-type: none">• Compact metro in North Central Florida surrounded by rural counties, distant from major population centers, dominated by U Florida, the land grant which also includes a medical school• Master planning is emphasizing infill between historic downtown and the university campus• Innovation & economic development one of six “pillars” of regional CEDS
Key Tools:	<ul style="list-style-type: none">• Sid Martin Biotech. 40,000 s.f. Incubator created in 1990 with long and well recognized track record, off campus in Progress Corporate Park• Florida Innovation Hub. 100,000 s.f. dry incubator at downtown campus, anchoring:• Innovation Square. Major live/work innovation district project planned for blocks between campus and downtown Gainesville, 1 major multitenant building already open, both wet and dry space• Entrepreneurship and Innovation Center. On-campus hub for student entrepreneurship, including consultancy with real startups and ‘hatchery’ for student ventures• Florida Opportunity Fund. Venture fund established with state’s allocation from Treasury SSBCI fund• Florida Virtual Entrepreneur Center. State-supported through Florida High Tech Corridor collaboration of the three major research universities.• StartupGNV (formerly GAIN). Not-for-profit organization encouraging local startups.• Additional lower-tech incubators including two at smaller institutions like Santa Fe College strongly supported by the Chamber and highlighted in regional strategies• Multiple commercial coworks, makerspaces, etc.• Florida Angel NEXUS. Statewide collaborative of regional angel groups and funds• Every county in the region (all 12 counties surrounding Alachua) qualify for planning support from the state Rural Economic Development Initiative
Successes:	<ul style="list-style-type: none">• Sid Martin claims its companies have attracted cumulatively \$500 million in capital (\$1.7 billion in funding including revenue and acquisitions), with 80% still in operation 5 years after graduation, and 16 of all biotech companies in-state started there• UF licensing office claims to have started more than 160 companies (about half biomedical, but also technology)
Challenges:	<ul style="list-style-type: none">• Relative isolation from state’s major business/corporate centers – 70 miles to Jacksonville, 110 to Orlando, 130 to Tampa• Chamber recognizes need to take strategy to a higher level, including better connecting startup creation to targeted industry clusters, and reducing outward brain drain
Best Practice Lessons:	<ul style="list-style-type: none">• Through patient nearly 30-year investment in Sid Martin Biotech, UF has moved beyond “Gatorade” to genuine standing in biotech world

Benchmark Case Study: Greenville, AL

Regional Context:	<ul style="list-style-type: none">• Mid-sized region anchored by presence of university research anchors in the region and a growing academic hospital creating a new medical school in collaboration with local universities.
Key Tools:	<ul style="list-style-type: none">• New innovation center campuses outside of the main Clemson University campus with focus on specific technologies, including:<ul style="list-style-type: none">• Clemson University International Center for Automotive Research (CU-ICAR), Greenville: Significant public-private partnership between growing automotive industry, Clemson University and the state to create a new R&D center of excellence in automotive technologies close to the industry cluster and about 45 minutes from the Clemson campus . Includes creation of a new graduate program in automotive technologies at the site that involves multi-disciplinary approach involving electronics, computing and advanced materials, supported by recruitment of eminent scholars. Home to company research centers, including BMW IT Research Center and Koyo Bearing R&D Center, plus offers a 60,000 sq ft Center for Emerging Technologies.• Clemson University Biomedical Engineering Innovation Campus, Greenville: A 30,000 sq. ft. lab located within a facility at the Greenville Health System campus, which is a spearhead to advance collaborations with a new academic medical center development taking place.• Clemson University Innovation Campus and Technology Park, Anderson, SC: Eight miles from the main Clemson campus. Home to university's Advanced Materials Research Lab, environmental labs and computing center; Duke Energy Innovation Center; and industry funded National Brick Research Center• Rise of mix of accelerator, incubator and maker-spaces in Greenville region: Led by the NEXT program of the Greenville Chamber, brings a strong focus on entrepreneurial and innovation-focused small businesses, with three different facilities, including one targeted for advanced manufacturing, mentoring programs, events and other ecosystem development efforts.
Successes:	<ul style="list-style-type: none">• \$250 million public-private partnerships in CU-ICAR has generated 770 jobs and another 720 jobs announced, plus major surrounding projects including 1,100-acre mixed use development with an expected population of 10,000, location of Hubbell Lighting Corporation headquarters, among other industry and health system investments.• NEXT Innovation Center reports assisting 102 companies, attracting \$23 million in new capital in 2017 and 261 new jobs paying on average \$69,443.
Challenges:	<ul style="list-style-type: none">• Linking major public-private innovation center developments with entrepreneurial activity.
Best Practice Lessons:	<ul style="list-style-type: none">• Creating new anchor research and innovation centers around industry clusters through university, industry and state partnerships

Benchmark Case Study: Nashville, TN

Regional Context:	<ul style="list-style-type: none">• Mid-sized region anchored by a major research university, strong music scene and leading healthcare companies
Key Tools:	<ul style="list-style-type: none">• The Nashville Entrepreneur Center a non-profit offering a range of fee-based services and memberships spanning coworking, networking, incubation and intensive mentoring/acceleration services:<ul style="list-style-type: none">• Co-Working space and Community access• Pre-Flight program for entrepreneurs to advance business ideas• In-Flight program for early-stage startups with up to three employees and \$150,000 in revenue• Accelerators focused on music industry and healthcare industry verticals that accept startups nationwide• Vanderbilt is an NSF i-Corps site and has graduated 17 teams; Vanderbilt's Wond'ry, the university innovation center, is aimed at developing an institutional innovation culture for faculty and students, and includes programs like Innovation Garage (industry-university collaboration on disruptive solutions), entrepreneurship courses, a makerspace, pitch events, and EIRs• Bunker Labs
Successes:	<ul style="list-style-type: none">• Branding from major LaunchTN entrepreneurial event, 36/86, is helping to create buzz for Nashville's entrepreneurial community, which is not strong in VC funding, overall net employment from young companies nor university tech transfer, but is attracting significant net in-migration and is generating significant numbers of high growth companies.
Challenges:	<ul style="list-style-type: none">• Very diffuse entrepreneurial community, with need to create stronger presence of innovation in the region, including more placemaking
Best Practice Lessons:	<ul style="list-style-type: none">• Importance of having a one-stop entity for entrepreneurship

Benchmark Case Study: Raleigh-Durham, NC

Regional Context:

- Mid-sized region anchored by major research universities with strong focus on innovation programs and place-making.

Key Tools:

- **NCBiotech Center:** Long-standing, dedicated program to growing life sciences in the region and across the state, including advancing research excellence, investing directly in emerging companies, ensuring trained workforce and advancing networking and peer groups in life sciences.
- **Major placemaking for technology with Research Triangle Park (RTP) and Centennial Campus at NC State.** RTP is one of the oldest and largest research parks in the U.S., but has been largely home to larger corporations, including a strong emphasis on biopharmaceutical. It is now reinventing itself with a new town center to offer more amenities and opportunities for emerging companies, plus single use facilities are being converted into multitenant facilities for start-ups and emerging companies, such as Alexandria Real Estate's new Agtech facility that used to be a Syngenta R&D facility.. Centennial Campus at NC State has been a leader on establishing innovation districts, leveraging the university as an anchor and creating close relationships between faculty, students and company tenants, while offering mixed use developments including housing.
- **Role of universities in commercialization.**
 - NC State is a national leader, with over 20 startups annually, dedicated funding through its Chancellor's Innovation Fund for proof-of-concept, a full-time site for NSF i-Corps, an Executive in Residence program to scout for technologies at university research labs, bootcamps and business plan competitions, strong entrepreneurial programs within its colleges and strong alumni networking of its start-ups (Wolfpack Investor Network).
 - UNC in 2010 launched a stronger focus on commercialization and entrepreneurship, including commercialization training launched through an EDA i6 grant, on-campus incubators, a downtown coworking space, proof-of-concept funding (Kickstart Venture Services), alumni investor network (Carolina Angel Network) and a \$10 million seed-stage investment fund created by the university's endowment known as Carolina Research Ventures Fund.
 - Duke University has also embraced entrepreneurship with fellowship program, startup challenge, an incubation fund and a prototyping facility for students, and in its technology transfer efforts participation in the Coulter program, active alumni angel network and partnerships with private sector incubators and accelerators (MedBlue incubator, Biomarker Factory and Center for Advanced Hindsight).
- Non-university physical developments, including coworking and incubator spaces, such as HQ coworking with three facilities in Raleigh and American Underground and BioLabs in Durham

Successes:

- Raleigh Durham is a top region for venture investment in high-potential innovation-driven companies, with over \$1 billion in venture funding to 173 companies, able to attract VC investment from East and West coasts, as well as having a strong base of SBIR backed companies.

Challenges:

- Linking major public-private innovation center developments with entrepreneurial activity.

Best Practice Lessons:

- University engagement in commercialization and innovation is key driver for the region. Builds on brand of being a major complex for university research and talent.

Benchmark Case Study: Susquehanna, PA

Regional Context:	<ul style="list-style-type: none">• Rural region with no university research anchors, but presence of non-research oriented colleges and universities.
Key Tools:	<ul style="list-style-type: none">• Presence of a Keystone Innovation Zone designation, one of 29 in the state, offering transferable tax-credits of up to \$100,000 based on growth in revenues to young companies under 8 years old, operating in innovation-led sectors and located in designated areas near colleges and universities.• Rural Business Innovation serves as hub for entrepreneurship including:<ul style="list-style-type: none">• Network of incubators located near local colleges and universities• Business technical assistance for accessing financing• Micro-startup grants of up to \$5,000• Student internships of up to \$2,000 per semester• Coordinator of local KIZ involving outreach and engagement with local businesses
Successes:	<ul style="list-style-type: none">• Diversified range of approximately 30 companies served across manufacturing, IT, and bio-health through incubators, internships, micro-loans and KIZ tax benefits• Eleven companies received KIZ benefits in 2017 generating nearly \$1 million in new sales and receiving \$444,000 in transferable tax credits.
Challenges:	<ul style="list-style-type: none">• Sustaining a rural economy by having new and small businesses generate job opportunities
Best Practice Lessons:	<ul style="list-style-type: none">• Demonstrates role that an entrepreneurial focused entity can have across a rural region partnering with local institutions• Shows that a targeted tax credit oriented towards young growing businesses in traded industry sectors can be effective in rural communities.

Benchmark Case Study: West Lafayette, IN

Regional Context:	<ul style="list-style-type: none">• Rural region with major research anchor
Key Tools:	<ul style="list-style-type: none">• Purdue's university driven research park developments. The Purdue Research Park, a 725-acre site on formerly university ag-related lands approximately 8.5 miles from main campus. Now home to 160 tenants. Home to a 105,000 sq. ft. university incubator and coworking space, which was developed with private contributions and bond funding from a state tax-increment financing program to create business incubators that offers \$5 million in bonding per incubator. Discovery Park District, a 400-acre mixed-use development immediately west of the main campus. It is the location for many of the university's commercialization and entrepreneurial development initiatives housed in the Burton Morgan Center for Entrepreneurship.• Purdue's Foundry is an accelerator-type program to help Purdue-affiliated entrepreneurs create startups offering access to EIR mentors as well as an umbrella for a range of entrepreneurial and commercialization initiatives including: Trask Fund for applied research and proof-of-concept funding of university inventions; an NSF iCorp site; a range of venture financing assistance, including a \$12 m Foundry Investment Fund, a pre-seed Elevate Purdue Foundry fund receiving state support, Purdue Startup Fund, Purdue Angels and pre-seed Ag-Celerator funding.
Successes:	Since the founding of the Purdue Foundry in 2013, there have been 165 startups created that generated more than \$270 million in funding and 200-plus new jobs.
Challenges:	<ul style="list-style-type: none">• Growing a broader and sustainable innovation ecosystem for the region that sees local startups stay rooted in the region as well as attract other growth-oriented companies.
Best Practice Lessons:	<ul style="list-style-type: none">• A major research anchor can both attract existing industry operations to locate nearby as well as create the tools to generate new startups from research inventions, and faculty and student ideas.



Innovating Tomorrow's Economic Landscape

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