



WEST VIRGINIA FORWARD

STRATEGY FOR ECONOMIC
DEVELOPMENT AND JOB GROWTH.



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1. Executive Summary

The image is a landscape photograph with a blue color cast. In the foreground, there are large, light-colored, textured rocks. Behind the rocks, a dense forest of evergreen trees is visible. The sky is a clear, deep blue. The text '1. Executive Summary' is overlaid in the upper left corner in a white, sans-serif font.

This West Virginia Forward collaborative is the result of an effort jointly conducted by West Virginia University and the State of West Virginia to identify new opportunities to diversify and strengthen the economy of West Virginia to enable economic growth and job creation. The work is meant to build upon existing analyses and ongoing endeavors in the State to offer ideas that can complement, enhance, and catalyze the impact of current initiatives. The West Virginia Forward effort analyzed the current state of West Virginia's economy, proposed new sectors into which it can diversify in the future, and assessed opportunities to improve the underlying competitiveness of the State by looking at four economic enablers: ease of doing business, innovation and business development, human capital, and infrastructure. The purpose of this document is to outline a summary of the findings and offer a blueprint that West Virginia Forward and different State stakeholders can implement in the future.

This document summarizes top-line findings from the research. However, the effort goes beyond this specific document, and includes outreach and syndication activities that ensure findings are actionable, a clear path forward on each dimension examined is defined, effective support among stakeholders is built-up, and the right conditions for implementation are set up.

The West Virginia Forward effort and the findings presented here are the result of a thorough fact-based research and analytic approach that brought together best practices and expertise from around the world, coupled with deep contextual knowledge of the State. West Virginia Forward's team was based in Morgantown and Charleston, and traveled across the State, supporting data analysis, trend assessments, financial modeling, and research. The team also hosted 10+ workshops, organized and led meetings with stakeholders across the State, and provided capacity building assistance via training and development of tools.

This strategy document synthesizes findings from 30+ national datasets from government and third-party sources, 80+ industry experts and researchers across topics as diverse as carbon fiber reinforced plastics, tourism, automotive manufacturing, energy, cyber security, broadband, human capital, innovation, infrastructure, project finance, and rural development, and more than 60 interviews with community leaders across West Virginia. The results are solutions that are validated by extensive outside data and comparisons with peer states, and tailored to the unique characteristics of West Virginia, with sensitivity to the unique qualities of the local context in which they will function. Comparative analyses with other states and regional peers were performed to understand areas of strength as well as opportunities for improvement to further strengthen West Virginia's competitive position. Findings were shared and discussed with a West Virginia Forward working group of 12 members from WVU, Marshall University, and the West Virginia Department of Commerce. The working group met regularly to discuss findings and align on the most impactful solutions for West Virginia. Key decisions were also shared with a Steering Committee composed of senior leadership from the institutions and other stakeholders.

The approach followed **five guiding principles**:

1. Build on the existing assets and value proposition that differentiate West Virginia from neighboring states (e.g., workforce loyalty evidenced by low turnover, low cost of doing business)

2. Prioritize solutions that create economic growth¹ and diversification²
3. Look for disruptive trends that create opportunities for differentiation³
4. Tailor opportunities to the assets and challenges of the different regions of the State
5. Focus on opportunities to deliver near-term job growth

Four **economic sectors** were highlighted as promising for West Virginia:

1. **Maintain and Support Existing Industries With Growth Potential:** Examples include mining, agriculture, aerospace maintenance, repair, and overhaul automotive parts manufacturing, metals manufacturing, fulfillment distribution, and the manufacture of building products.⁴
2. **Sectors with a current West Virginia presence that the State can retain or grow through differentiation:** Examples include downstream oil & gas manufacturing (carbon fiber reinforced plastics (CFRP)⁵ and fine chemicals)⁶. The sector will benefit from the ongoing upstream developments arising from the shale gas development.
3. **New sectors that have high growth prospects⁷ that West Virginia can capture:** Examples include cybersecurity, cloud services, and data centers, and higher end tourism⁸.
4. Sectors with distinct opportunities that West Virginia can consider for longer-term growth opportunities: Examples include life sciences⁹ and automotive assembly¹⁰.

Since accessing all of these opportunities hinges critically on West Virginia’s competitiveness, West Virginia’s performance was benchmarked against regional peers. Areas of strength to leverage were highlighted, while opportunities for improvement were identified based on analysis of how WV compares to its neighboring states. Key **findings across the four economic enablers** include:

1. **Ease of doing business:** Although the State has made recent changes to its tax environment and passed civil justice reforms seen as favorable by the business community¹¹, rising

¹ By considering only industries that are forecasted to grow more quickly than the State’s 10-year real GDP growth rate, the focus was narrowed to sectors that could spark faster growth in West Virginia.

² Analysis was based on data from Moody’s Analytics, aggregated from the 2015 BEA gross product originating dataset, US Bureau of Labor Statistics quarterly census of employment and wages, and current employment statistics for 2015.

³ From the McKinsey Global Institute report: “Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy”.

⁴ While these sectors are of historic and current importance, West Virginia Forward focused its research efforts on sectors which were less well known to stakeholders, provided opportunities for diversification away from the historical industry mix, and had greater potential for future growth. Current efforts for diversification within these sectors were noted by West Virginia Forward and are of interest for continued support.

⁵ Additional analyses used data from the US Census Bureau 2015 Annual Survey of Manufacturers; State of the Composites Industry, Reinforced plastics, November/December 2014 issue, Teal Group; analyst reports on 2015 aircraft production.

⁶ Projections based on forecasts from IHS Chemical, Lucintel, Composites World, and European Bioplastics (EUBP).

⁷ Projection calculated based on forecasts conducted by Moody’s analytics, Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), and Gartner.

⁸ Analyses used data extrapolated from 2014 Longwoods survey of WV tourists conducted for the Division of Tourism.

⁹ Projections based on forecasts from Markets and Markets, BCC research, and Grandview research.

¹⁰ Opportunities identified based on interviews in April, May, and June 2017 with automotive industry experts.

¹¹ Tax Foundation database on state-by-state taxation policies.

electricity prices¹² are affecting the competitiveness of its cost of doing business, while below average “quality of life” outcomes, like health and educational attainment¹³, affect its attractiveness for talent. The state needs to make a concerted effort to better market West Virginia’s favorable environment compared to its neighbors, as well as the recent improvements that were undertaken.

2. **Innovation and business development:** There is an opportunity to better attract new businesses to the State by:
 - Enhancing the role and resources of the West Virginia Development Office,
 - Launching a site certification program, and
 - Recalibrating the current mix of incentive types offered to businesses.

The State can also further support local small businesses by partnering with universities to offer support services and create a one-stop-shop for businesses looking for assistance.

3. Finally, there is an opportunity to support the innovation ecosystem in the State by creating an Innovation Council, supporting startups through a “Startup Catalyst” Program, and attracting more venture funding, especially at the early stage
4. **Infrastructure:** West Virginia has faced challenges in improving its transportation¹⁴ and broadband¹⁵ infrastructure, given fiscal pressures. As such, the State could benefit from exploring innovative financing mechanisms that leverage private sector financing to fund capital-intensive projects, as well as leveraging its own assets to generate new sources of revenue for infrastructure financing.
5. **Human capital:** With multiple ongoing efforts to address the different human capital challenges across the State (e.g., workforce participation¹⁶, educational attainment¹⁷ and number of STEM graduates), there is an opportunity to unite these efforts and ensure funding is targeted at the highest impact, coordinated programs. A human capital task force could bring together education providers, major employers, and existing institutions working within the human capital space across West Virginia to identify and launch an integrated strategy that addresses existing challenges to the labor force across three dimensions: size of the talent pool, skill level of the talent pool, and talent retention and attraction. Business leaders noted that in addition to skills-based challenges, worker health and workforce participation are concerns, which both limit the size of the workforce available and their skills. As such, efforts

¹² Energy Information Administration (EIA) electricity cost data. An upward trend in electricity costs has emerged over the past two years (7% annual growth in price of industrial electricity costs) that has brought the State close to the national average for industrial electricity costs.

¹³ US News & McKinsey Leading States Index; pre-K enrollment data from US census American Community Survey; math and reading scores data from National Center for Education Statistics; obesity date from CDC Behavioral Risk Factor Surveillance; mortality data from CDC Wonder; Medicare data from Center for Medicare Services.

¹⁴ US Department of Transportation data on deficient bridges.

¹⁵ US Census Bureau’s data on broadband access.

¹⁶ Labor force participation rates, Moody’s Analytics 2007-2016

¹⁷ National Center for Education Statistics, 2014

focused on talent could be complimented by efforts to address the health challenges faced by the State's working population, most notably the opioid crisis¹⁸.

To implement effectively the economic development strategy, West Virginia Forward has outlined an implementation plan that is anchored around a memorandum of understanding (MOU) among the three partners. Through the MOU, each signatory commits to undertake a series of initiatives based on the findings of the report, and all three partners will also commit to engage the relevant stakeholders across the State to ensure successful implementation of each initiative in the coming months. Additional work to begin implementation, engage stakeholders, and expand the West Virginia Forward effort will continue in the fall of 2017.

The intent of West Virginia Forward is that the findings and initiatives outlined will give West Virginia the tools to achieve both short and long term success in revitalizing the economy, creating jobs, and priming the State for success in the changing economic and technological landscape of the 21st century.

For those interested in learning more or getting involved, please contact Rochelle Goodwin, with West Virginia University, at wvforward@mail.wvu.edu or Sara Payne Scarbro, with Marshall University, at wvforward@marshall.edu. Updates on progress and the latest information can be found at wvforward.wvu.edu.

¹⁸ West Virginia Economic Outlook 2017-2021 – Bureau of Business and Economic Research at WVU College of Business and Economics; America's Health Rankings



2.

Introduction: Context and Background

In recent years, West Virginia has suffered an economic decline due to a convergence of factors, including the financial crisis, loss of manufacturing jobs, and more recently the downturn of the coal industry. Although the US economy has recovered and grown over the past years, West Virginia has struggled to match those trends, as its economy remained stagnant until 2016, and only recently started to grow again.

In response, leaders from West Virginia University (WVU), the State of West Virginia, and Marshall University came together to identify solutions that can revive the fortunes of the State. In addition to ongoing efforts from local and regional actors across the State to support economic recovery and growth, several key players agreed to embark on West Virginia Forward to define a path for economic development across the State. This report summarizes key points from this work, building on existing efforts in the State and defining ways for the State government, WVU, and Marshall to achieve **three main objectives**:

1. Identify potential industrial sectors where West Virginia can grow and diversify its economy
2. Define actions that can improve the State's economic environment across infrastructure, human capital, innovation and business development, and the ease of doing business
3. Create a clear roadmap for implementation that will enable effective execution of the defined initiatives by different actors across the State

In order to avoid redundancy and build upon existing findings and knowledge, West Virginia Forward focused on contributing additional insights to existing thinking. As such, topics that were covered in previous reports such as Workforce WV's "Economic Review" and "Workforce Development System Report", the "West Virginia Economic Outlook" report published by the Bureau of Business and Economic Research at West Virginia University and the STEM jobs report¹⁹ by TechConnect were reviewed but were not re-examined in depth here.

¹⁹ "A Survey: STEM Jobs in West Virginia in 2015"

3. Approach



The West Virginia Forward effort examined West Virginia across five dimensions of economic development – sector diversification, business climate, innovation and business development, infrastructure, and human capital – including assessing current strengths and weaknesses, defining opportunities for improvement, and detailing potential actions that the State can take over the short and long term to promote economic development and job growth. This strategy document summarizes the top-line findings from this effort. However, the work goes beyond this specific document, as the project was primarily focused on ensuring the findings are actionable, by defining a clear path forward on each dimension examined, building support among stakeholders, and setting up the conditions for implementation.

The West Virginia Forward effort and the findings presented here are the result of a thorough fact-based research and analytic approach that brought together best practices and expertise from around the world, coupled with deep contextual knowledge of the State. West Virginia Forward’s team was based in Morgantown and Charleston, and traveled across the State, supporting data analysis, trend assessments, financial modeling, and research. The team also hosted 10+ workshops, organized and led meetings with stakeholders across the State, and provided capacity building assistance via training and development of tools.

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The approach was anchored on **five guiding principles**:

1. **Build on existing assets:** understand West Virginia’s assets and sources of competitiveness relative to peers and focus on opportunities that can leverage those assets (Exhibit 1). Specifically, West Virginia outperforms neighboring states (Virginia, Ohio, Maryland, Pennsylvania, Kentucky) on workforce loyalty as measured by employee turnover, cost of labor, and business climate perceived by businesses as favorable (tax and legal)

Metric	WV	OH	PA	MD	VA	KY
Employee turnover rate	8.8%	9.3%	9.5%	9.5%	10.8%	9.9%
Home ownership rate (Q4 2016)	74.2%	66.4%	67.7%	65.6%	66.4%	69.6%
Avg. earnings per hour (non-farm employment)	\$21	\$23	\$24	\$27	\$26	\$21
Cost of living % of national average)	95.7%	93%	102.8%	125%	100.2%	95.7%
Cost of doing business (% of national average)	93%	97%	101%	105%	101%	94%
Business tax climate State ranking	18	45	24	42	33	34

Exhibit 1: Comparative analysis of West Virginia's assets relative to neighboring states²⁰

2. **Growth and diversification:** the methodology focused on identifying opportunities that can both grow the economy and differentiate it beyond the sectors that are already established (Exhibit 2):
 - **Economic growth:** focus was on sectors large enough to significantly grow the economy (defined as State GDP > \$500M) and that are growing at a faster rate than the State (defined as forecasted annual GDP growth rate > 0.8%²¹)
 - **Diversification:** looking at each industry's location quotient²², projected growth in West Virginia and projected growth nationally, sectors of West Virginia's economy were segmented into 'Win', 'Grow', 'Retain', or 'Capture' segments

²⁰ Data from the US Census Bureau, MERIC, Forbes, Moody's analytics, Tax Foundation, Institute for Legal Reform, State Departments for Commerce, and the Association of American Railroads.

²¹ Forecasted 10-year real GDP growth rate of West Virginia. By considering only industries that are forecasted to grow more quickly than the State's economy, the focus was narrowed to sectors that should spark faster growth in West Virginia.

²² The location quotient (LQ) is defined as the ratio of the proportion of jobs in the State by a specific industry to the proportion of jobs in the US accounted by that same industry. Therefore, it provides an assessment of how specialized a State is in a specific industry. An LQ greater than one indicates that a State is over-indexed in a specific industry, while an LQ less than one indicates that a State is under-indexed relative to the US.

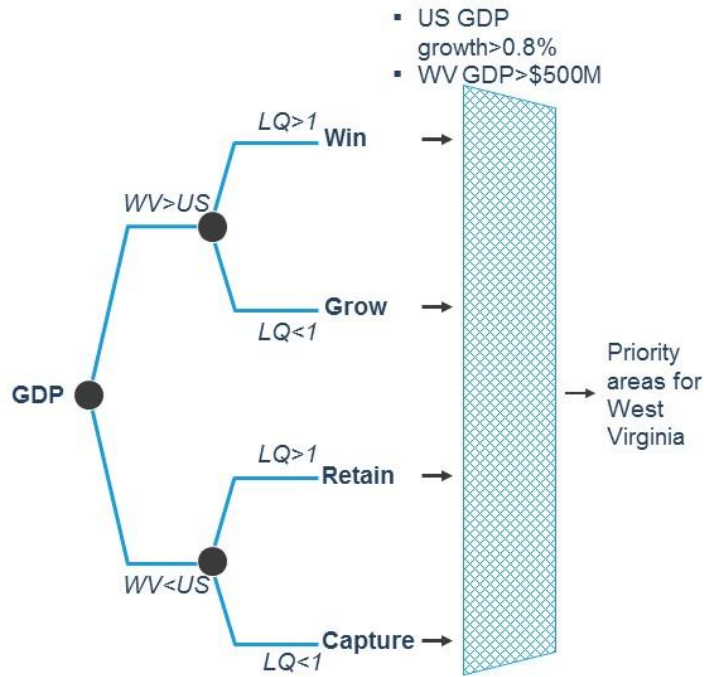


Exhibit 2: Methodology for sector prioritization²³

3. **Disruptive trends:** within priority sectors, identify segments where technological disruptions offer opportunities for differentiation on which West Virginia can capitalize (Exhibit 3)

²³ Analysis was based on data from Moody's Analytics, aggregated from the 2015 BEA gross product originating dataset, US Bureau of Labor Statistics quarterly census of employment and wages and current employment statistics for 2015.












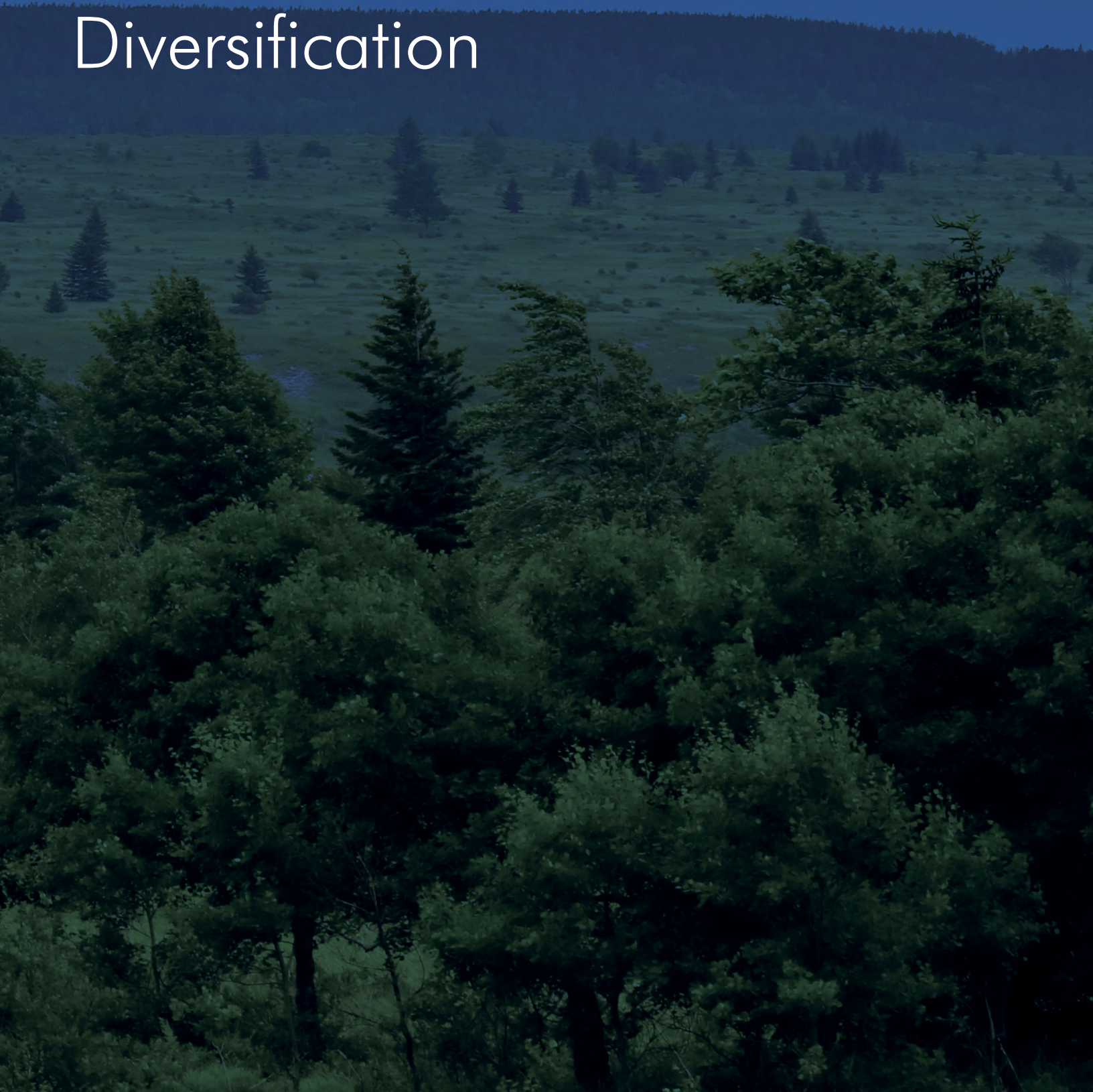
	Cloud Technology	Use of computer hardware and software resources delivered over a network or the Internet, often as a service
	Internet of Things	Networks of low-cost sensors and actuators for data collection, monitoring, decision making, and process optimization
	NextGen Genomics	Fast, low-cost gene sequencing, advanced big data analytics, and synthetic biology ("writing" DNA)
	Autonomous Vehicles	Vehicles that can navigate and operate with reduced or no human intervention
	3-D printing	Additive manufacturing techniques to create objects by printing layers of material based on digital models
	Advanced Robotics	Increasingly capable robots with enhanced senses, dexterity, and intelligence used to automate tasks or augment humans
	Automation of knowledge work	Intelligent systems that can perform knowledge work involving unstructured commands and subtle judgments
	Advanced materials	Materials designed to have superior characteristics (e.g., strength, weight, conductivity) or functionality
	Energy Storage	Devices or systems that store energy for later use, including batteries
	Mobile internet	Increasingly inexpensive and capable mobile computing devices and Internet connectivity
	Advanced oil and gas extraction	Exploration and recovery techniques that make extraction of unconventional oil and gas economical

Exhibit 3: Description of major global technological disruptions²⁴

4. **Regional impact:** maintain a focus on regional assets and challenges when prioritizing industries. The diverse set of assets available across the State's different regions can enable West Virginia to grow its economy across multiple sectors. For example, in addition to opportunities springing from the natural gas in the northern part of the State, the effort identified attractive tourism assets in the south and south east (especially second homes and adventure tourism), supplements to the historical chemicals manufacturing footprint in the West, and opportunities for major distribution hubs in the Northeast.
5. **Quick wins:** highlighting opportunities within findings that can be implemented and have impact within the next year

²⁴ McKinsey Global Institute report: "Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy"

4. Sector Diversification



Looking at existing State assets, disruptive trends, location quotient data²⁵, and comparative industry growth trends in the US and West Virginia, the analysis categorized economic sectors into the following **four groups**:

1. **Existing industries in the State to maintain and support:** mining, agriculture, aerospace maintenance, repair, and overhaul (MRO), automotive parts manufacturing, metals manufacturing, fulfillment distribution, and the manufacture of building products
2. **Sectors with a current West Virginia presence that are growing slower than US average, but that the State can retain through differentiation:** downstream oil & gas manufacturing (specific opportunities in carbon fiber reinforced plastics (CFRP) and fine chemicals). The sector will further benefit from ongoing upstream developments that are expected to increase the State's competitiveness across the whole value chain
3. **New sectors that have high growth prospects that West Virginia can capture:** cybersecurity, cloud services, and data centers, and higher end tourism
4. **Sectors with distinct opportunities that West Virginia can consider:** life sciences and automotive assembly

For existing industries, findings confirmed West Virginia's strong presence with example assets like the growing footprint of original equipment manufacturers (OEMs) that includes Toyota, Hino, Gestamp, and Alleward Sogefi, an aerospace maintenance, repair, and overhaul (MRO) hub at the Mid-Atlantic Aerospace Complex, and distribution and fulfillment centers for large companies such as Macy's.

For CFRP, fine chemicals, cybersecurity, cloud services, and higher end tourism, "deep dive" analyses were used to develop a plan for West Virginia to capture the opportunity in the short and long term by considering:

- What are the recent market trends
- What it takes to be competitive in the sector
- What are West Virginia's relevant assets in the sector
- What West Virginia can consider doing to strengthen its positioning

In life sciences and automotive assembly, analysis identified distinct opportunities for the State to explore in order to increase its presence in both sectors.

4.1 DOWNSTREAM OIL AND GAS MANUFACTURING

West Virginia is located on the Marcellus and Utica shale formations, which stands among the richest natural gas reserves in the world and is expected to double its production in coming years as extraction and recovery of unconventional oil and gas reserves continue to become more economical and as natural gas prices rise. There is recognition across the State about the importance of better leveraging the natural gas opportunity by creating a cluster around natural gas that goes beyond simple extraction and export of the commodity. Hence, there are ongoing efforts in the region broadly, including in West Virginia, to create the storage, processing, and transportation infrastructure that will catalyze growth in

²⁵ The location quotient (LQ) is defined as the ratio of the proportion of jobs in the State by a specific industry to the proportion of jobs in the US accounted by that same industry. Therefore, it provides an assessment of how specialized a State is in a specific industry. An LQ greater than one indicates that a State is over-indexed in a specific industry, while an LQ less than one indicates that a State is under-indexed relative to the US.

this sector and allow the State to reap greater value from these resource. As these projects come to market, cheap feedstock will further enable the cost-competitiveness and growth of industries such as petrochemicals.

Given the large investments required upstream and the ongoing projects in the state, West Virginia could look at opportunities downstream that leverage its strengths and cost-competitiveness over the short term, and can further take advantage of ongoing projects over the long term. Downstream industries are also more job intensive and require less capital investments (e.g., specialty chemicals has a 1.42 GDP multiplier and 1.87 job multiplier²⁶).

While there were several options considered downstream (Exhibit 4), looking at West Virginia’s assets, ability to meet business needs and market attractiveness of each option helped prioritize two main opportunities: carbon fiber reinforced plastics (CFRP) and fine chemicals.

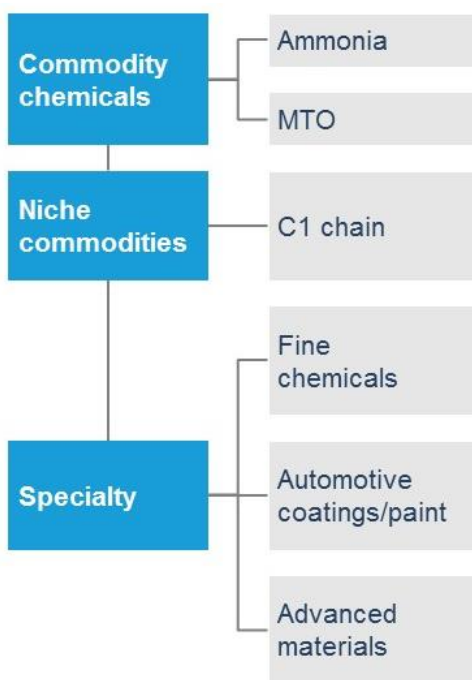


Exhibit 4: Downstream O&G manufacturing applications

4.2 CARBON FIBER REINFORCED PLASTICS

The carbon fiber reinforced plastics (CFRP) market is projected to grow at more than 10% per year for the next decade²⁷, and there is a wide array of potential applications in industries ranging from automotive and aerospace to infrastructure, as well as a growing need for recycling of CFRP parts, which provides lower-cost inputs for low-grade applications of the fibers themselves.

West Virginia already has assets in CFRP production and research on which it can capitalize:

²⁶ Emsi’s Multi-Regional Social Accounting Matrix (MR-SAM) modeling system for estimating the ripple effects (multipliers) on an economy of growth in a specific industry, 2015 data.

²⁷ Projection triangulated using forecasts from IHS Chemical, Lucintel, CompositesWorld, and European Bioplastics (EUBP).

- Existing companies such as Aurora, Orbital ATK, and FMW Composite systems already manufacture CFRP products
- West Virginia has research centers that are building a competency in testing and prototyping new materials for various applications. These include entities such as Chemical Alliance Zone, ChemCeption (incubator-accelerator with a sole focus on commercializing chemical technologies), MATRIC, Touchstone, collection of test and evaluation sites under the Defense Innovation Proving Ground and university constructed facilities centers
- Special economic zones (Polymer Alliance Zone and Chemical Alliance Zone) with preferential policies, tax breaks, and expedited permitting for high-tech, specialty, and engineering polymers
- A series of tax credit programs that are relevant to CFRP production (Exhibit 5)

Name	Description	Amount
Commercial Patent Incentives Credit	A credit based on a percentage of royalties, license fees, etc., if patents have been developed in concert with WVU or MU	Up to 100% of the corporate net income tax
Corporate Headquarters Credit	Credit for corporations who move headquarters to WV and create at least 15 new jobs within the 1 st year	Up to 100% of the business and occupational tax for up to 13 years
Economic Opportunity Credit	Credit allowing companies who create at least 20 new jobs within specified time limits to offset the corporate net income tax; if less than 20 new jobs, allows a credit per job if it pays at least \$32,000 per year and provides health insurance benefits	Up to 80% of net income tax or \$3,000 per new full-time job for 5 years
High-Tech Manufacturing Credit	Credit for businesses creating computers, peripheral equipment, electronic components, or semi-conductors and who create at least 20 new jobs within one year	Up to 100% of the business and occupational tax, personal income tax on certain income for 20 years
Manufacturing Inventory Credit	Credit to offset the corporate net income tax in the amount of property tax paid on raw materials, work in process inventory, and finished goods inventory	Dependent on volume of inventory
Manufacturing Investment Credit	A credit allowed against tax based on qualified investment in eligible manufacturing property	Up to 60% of corporate net income
R&D Sales Tax Exemption	Credit for purchases of tangible personal property and services directly used in R&D are exempt from the consumer sales tax	Up to 100% of consumer sales tax

Exhibit 5: Manufacturing tax credits available in West Virginia

West Virginia can aspire to create an advanced materials cluster, specifically focusing on the opportunity in CFRP. Analysis identified three areas that West Virginia can consider pursuing:

- Commercialize existing CFRP infrastructure patents in the State (e.g., WVU and Marshall patents) such as CFRP replacement for steel rebar in concrete on bridges that is lighter and longer lasting than steel, CFRP wrap for steel and concrete beams and joists that provide superior durability and earthquake resistance in new and retro-fitted high-rises, or CFRP reinforced power and cell phone poles that require smaller footprint. Leveraging existing \$2B yearly spend on bridge repair/replacement locally and in neighboring states²⁸, there is sufficient demand to make the case for profitable commercialization of existing patents

²⁸ Calculation used data from the Federal Highway Administration State Highway Agency Capital Outlay Reports, 2012 and 2014.

- Attract a CFRP recycling plant that can take advantage of existing aerospace production in neighboring states (estimated 1.1K tons of annual aerospace carbon fiber materials production in OH, PA, MD, VA and KY²⁹) to recycle CFRP aerospace parts that can be used in other applications such as automotive, at 30-40% lower cost than new ones
- Leverage existing automotive footprint to develop partnerships around developing, testing and prototyping CFRP applications in the State

Doing so will require state-wide support and investment in human capital and business development that will help grow the cluster by increasing the speed of patent commercialization and expanding the advanced materials talent pool in the State. Specific actions that could be taken in that regard include:

- Expand offering of materials sciences degrees at universities, including creating an undergraduate program
- Attract CFRP researchers and faculty to the State
- Create partnerships between universities, research centers, and existing and prospective manufacturers to catalyze innovation in the field

4.3 FINE CHEMICALS

The fine (or “high-purity”) chemicals market includes nearly 100,000 intermediates and more than 5,000 active ingredients. In addition to having higher profit margins than basic chemicals, these products can also benefit from cheaper feedstock of natural gas, thus providing competitive advantages to companies.

West Virginia’s assets in fine chemicals are three fold:

- Existing footprint in the chemicals and plastics manufacturing industry that offer opportunities for colocation of manufacturers of products along the same value chain
- Potential for local downstream buyers in the State (e.g., Procter & Gamble)
- Opportunity for low cost access to natural gas that will become more attractive as storage and pipelines open to market

There is an opportunity for the State to differentiate by attracting manufacturers of compounds directly downstream from existing production that benefit from lower costs of input and have attractive profit margins. Potential products to consider include derivatives of naphtol, chlorine, cyanuric acid, dimethyl sulfate, hydrogen cyanide, naphthalene or nonylphenol. From these, there are three characteristics that West Virginia can consider to focus attraction efforts:

- Higher growth compounds with rising demand, such as sodium cyanide (4% forecasted yearly growth in next 5 years on a current market size of 1.1 Mton³⁰)

²⁹ Based on current aerospace production by state as a proportion of global production, and assumed similar proportion of state aerospace carbon fiber production relative to global aerospace carbon fiber production – US Census Bureau 2015 Annual Survey of Manufacturers; State of the Composites Industry, Reinforced plastics, November/December 2014 issue, Teal Group; analyst reports on 2015 aircraft production.

³⁰ Forecasts drawn from Chemical Economics Handbook (CEH) reports for sodium cyanide and hydrogen cyanide.

- Niche commodities, such as chlorinated methane, which offer opportunities for differentiation in products with higher profit margins
- Intermediaries that can be used for existing production in the State and that integrate the supply chain, such as nonylphenol ethoxylates, which can be used for detergent and personal care products by local manufacturers

In addition to targeted attraction activities, actions that West Virginia could consider to lower the cost of operations of prospective fine chemicals producers include:

- Implement a site certification and remediation support program to help develop brownfield sites and decrease initial capex investment needed
- Take actions to limit and reverse the recent rise of industrial electricity costs (West Virginia has lower industrial electricity costs than MD and PA and is on par with VA and OH, but has been facing a trend of rising costs³¹. See Exhibit 17 and Section 5: Ease of Doing Business)
- Create opportunities for existing chemicals manufacturers to collocate with new downstream producers
- Expand the available talent pool of higher education graduates with science and engineering degrees to complement existing skill labor and meet the industry expectations
- Consider arrangements similar to the Chemical Alliance Zone that offer incentives that match efforts by other states (e.g., NJ has a 100% R&D tax credit) and that help expedite permitting for prospective companies

4.4 HIGHER END TOURISM

West Virginia attracts fewer higher income and older travelers compared to the broader tourism market in the United States (Exhibit 6).

³¹ Energy Information Administration (EIA) electricity cost data

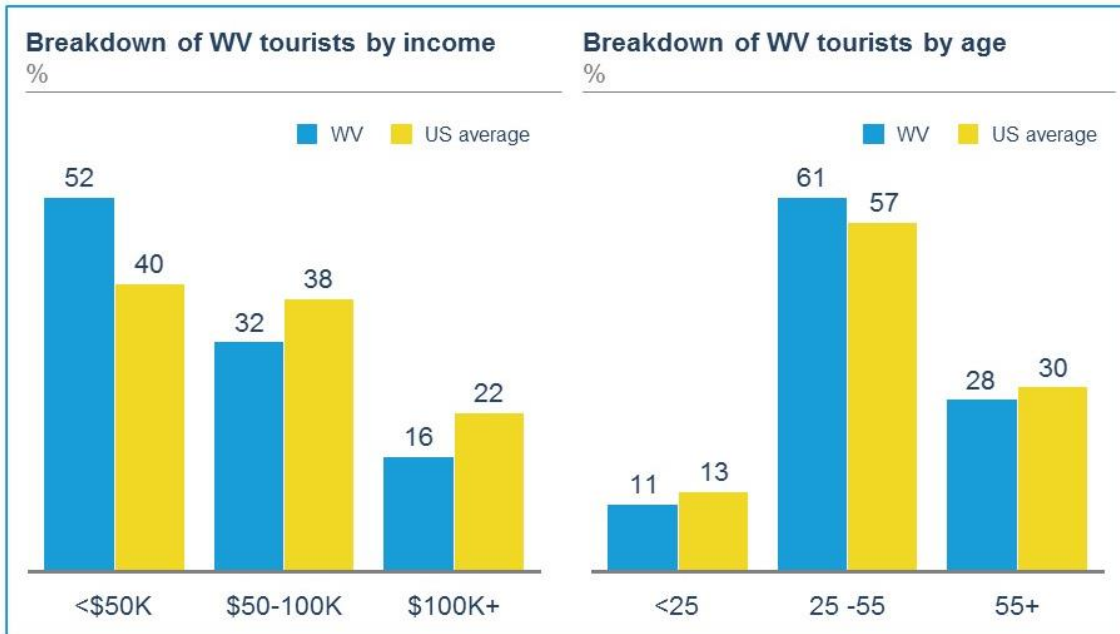


Exhibit 6: Breakdown of West Virginia tourists by income and age group³²

Given the fact that higher income and older tourists tend to spend more on tourism (Exhibit 7), this helps explain findings from the State’s Division of Tourism showing that visitors to the State had an average length of stay of only 2.73 days in comparison to a national average of 4 days, and that the annual travel spending for the State was only \$4.5 billion, whereas the average annual spend for surrounding states stands at more than \$20 billion.

³² Data extrapolated from 2014 Longwoods survey of WV tourists conducted for the Division of Tourism.

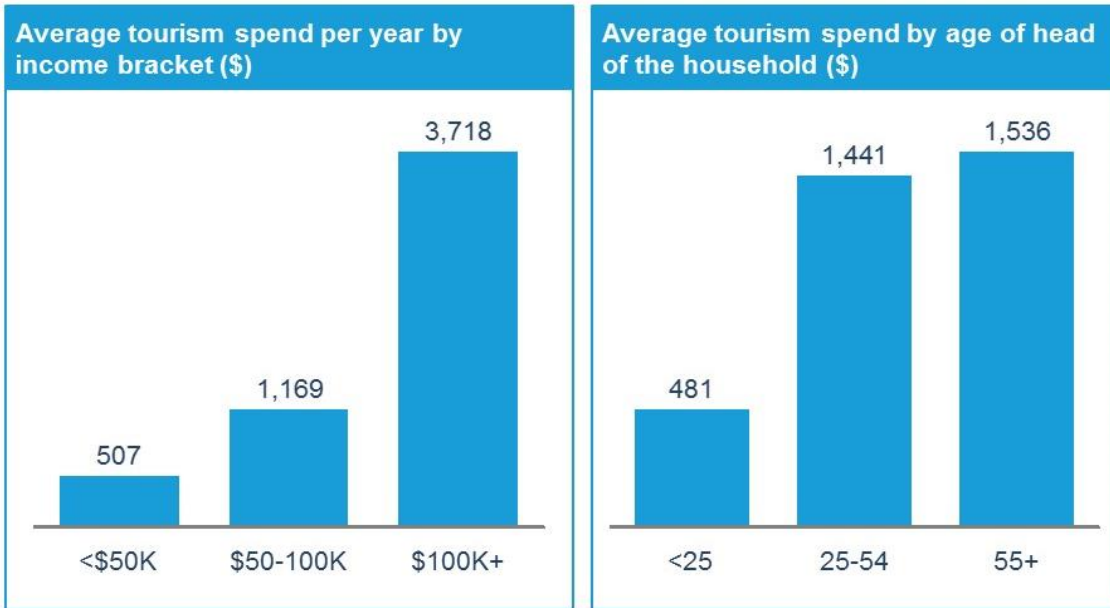


Exhibit 7: Average annual tourism spend by income and age group³³

However, a survey of the Census tracts within 3-hour to 4-hour drives of the State suggested that there are large populations of older and higher-income tourists that could be the target for attraction efforts by the State (Exhibit 8).

³³ "Low-income" was defined as incomes below \$50k per year, "Middle-income" was defined as incomes between \$50k and \$100k per year, and "High-income" was defined as incomes higher than \$100k per year – Bureau of Labor Statistics.

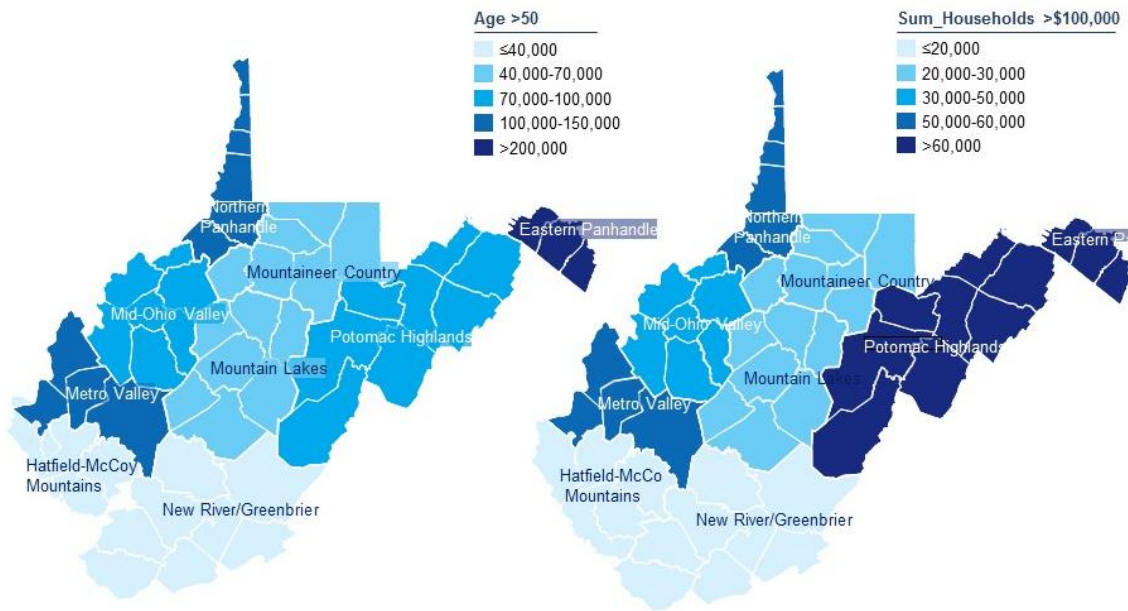


Exhibit 8: Mapping of populations aged >50 and households with >\$100K income within a 3h drive of West Virginia regions³⁴

West Virginia has unique regional assets, which can be leveraged to attract higher income and older prospective tourists, in turn creating economic opportunity more broadly across the State than other sector-based efforts, which may cluster in a specific region. Specifically, there are three main opportunities to explore:

- Attract wealthier and older segments of adventure travelers in the south of the State (in the New River Valley and Hatfield-McCoy Mountain tourism regions). Given the higher end and family oriented preference of such adventurers, potential actions to consider include:
 - Attract higher end hotels
 - Attract large family adventure resort (e.g., a waterpark resort)
 - Capture more value from current ATV tourists by supporting local ATV businesses and communities and linking them to local hospitality resources
 - Promote cooperative tourism development to encourage trip packages, and integrated journeys that decrease uncertainty for high-spend tourists and encourage more differentiated spend
- Expand existing cluster of second homes in the eastern regions of West Virginia (and especially the Potomac Highlands). As a first step, West Virginia could market the existing second homes in counties like Pocahontas and Pendleton. With effective market surveys of and tailored offerings to populations in large metropolitan areas surrounding the State that are likely to buy second homes, West Virginia could further expand the second home footprint in the eastern regions on the longer term. In addition, West Virginia can work with local communities on efforts that increase attractiveness and quality of life of neighborhoods to second home buyers

³⁴ Data extrapolated from US Census Bureau tracts captured by Alteryx Drivetime modeling.

- Attract high income retirees in the northern regions of the State through development of luxury assets in proximity to current needs of such tourists (e.g., quality healthcare centers). Effective mapping of existing assets and offerings that are relevant to this population can help create a targeted development and branding strategy

4.5 CYBERSECURITY, CLOUD SERVICES AND DATA CENTERS

The IT services sector has been growing at a 5% yearly rate in the US, with its growth expected to create jobs (job multiplier of 1.68)³⁵. Specifically, cloud computing services (28% yearly rate), data centers (16% yearly rate) and risk management (11% yearly rate) are forecasted to grow rapidly over the next 5 years³⁶, offering a significant opportunity for the State to capture and diversify its economy. As noted in Section 7, broadband infrastructure is a critical underlying component of any effort to make the State attractive in cybersecurity, cloud services, or data centers. In the short term, company attraction can focus on the sites within the State with sufficient coverage and speeds, and in the long term can expand as broadband access expands.

West Virginia has existing assets in the industry and structural advantages that make it an attractive destination for cybersecurity and cloud services companies:

- West Virginia is home to a number of federal agencies and high tech federal operations (e.g., FBI, NASA, NOAA, DOE National Energy Technology Lab, Allegany Ballistics Lab as well as over 25 satellite federal operations, many of which are data driven such as the Bureau of Fiscal Service, the Coast Guard Operations Systems Center, the Coast Guard National Maritime Center, the Coast Guard National Vessel Documentation Center, the IRS Computing Center, and the BATF National Tracing Center) and two of the three federal biometric centers are housed in the State. In addition, there are facilities such as the I-79 Technology Park that are equipped with the infrastructure that cloud services and data centers require. Moreover, the Bureau of the Fiscal Service Parkersburg site could serve as an anchor for cybersecurity companies given the scale and sensitivity of data it processes
- State location allows it to house Continuity of Operations (“COOP”) compliant facilities
- Preferential tax policies that are relevant to data centers such as exemptions on property taxes as well as cheaper land costs
- Although West Virginia has a smaller talent pool than neighboring states, the current excess of graduate IT students could fill new IT jobs that are created in the State at a lower cost (Exhibit 9)

35 Emsi’s Multi-Regional Social Accounting Matrix (MR-SAM) modeling system for estimating the ripple effects (multipliers) on an economy of growth in a specific industry, 2015 data.

36 Projection calculated based on forecasts conducted by Moody’s analytics, Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), and Gartner.

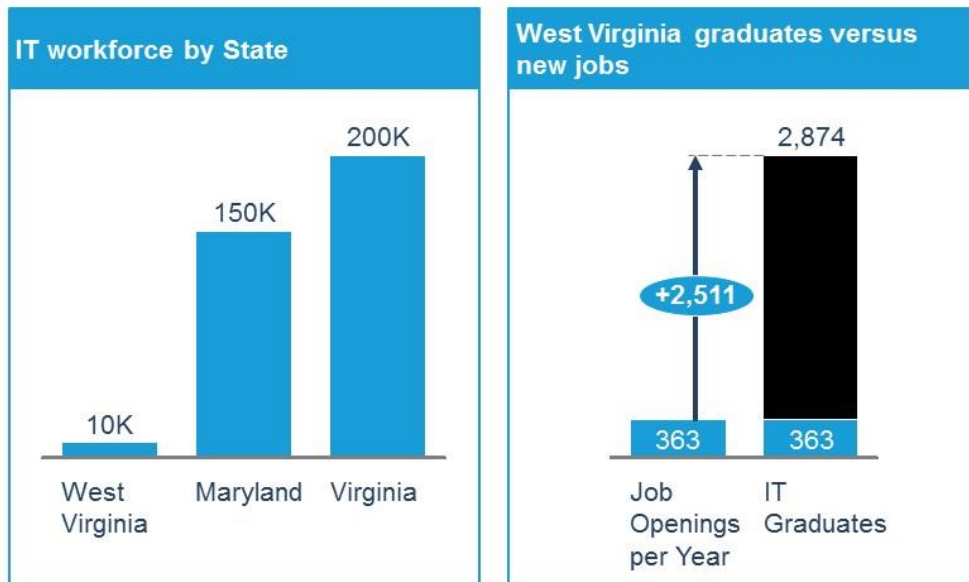


Exhibit 9: Size of West Virginia IT workforce supply and demand³⁷

Growing a cybersecurity sector is a long term investment that will require growing the State’s talent pool and fostering an innovation environment that allows for creation and growth of startups, as new business creation is the major driver of the sector’s growth. Over the short term, West Virginia can consider attracting anchors that can help progressively grow an IT services sector in the State, including:

- New federal anchors whose long term presence can create opportunities for local graduates, as well as for private sector contracting services. Specifically, West Virginia could make the case for consolidating federal biometrics facilities in the State
- Data centers and cloud services companies that can find opportunities for lower cost operations in the State. Comparative analysis shows that West Virginia has a competitive offering relative to current hubs that it can actively market (Exhibit 10). It is important to note that although operating costs will be low, such companies will need sites with the effective infrastructure to operate a data center (e.g., dual broadband access, connection to the fiber optics backbone). Such sites are currently limited in the State and will have to be expanded to take full advantage of this opportunity

³⁷ Calculations drawn from data publicized by Bureau of Labor Statistics (BLS), EMSI, and National Center for Education Statistics (NCES).

■ Annual Taxes ■ Total annual energy cost ■ Total annual wages

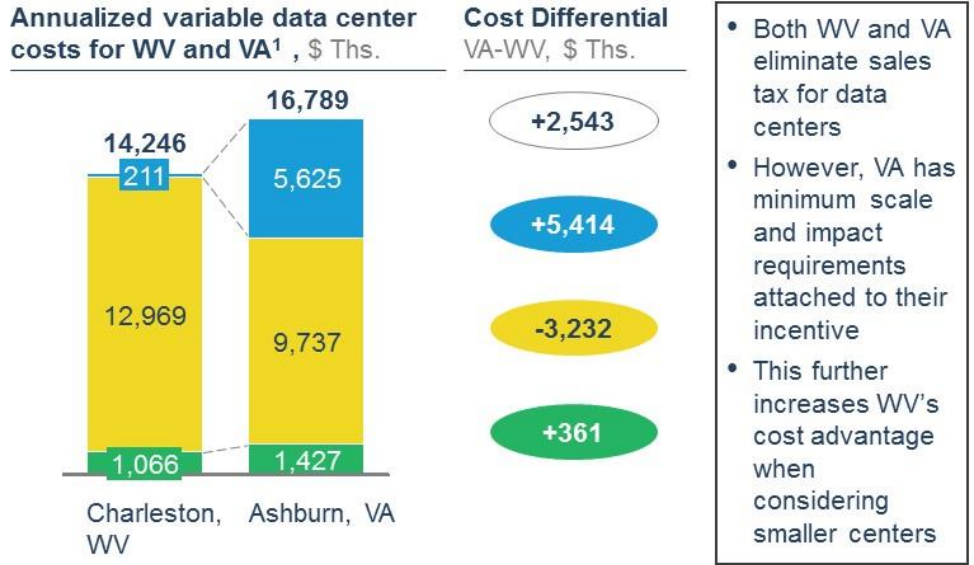


Exhibit 10: Comparative analysis of data center operating costs in West Virginia and Virginia³⁸

- Attract anchor tech companies, specifically focusing on identity and access management, leveraging existing biometrics facilities and training programs
- Beyond specialized IT companies, West Virginia can also consider attracting IT shared services centers of any large company, leveraging their competitive positioning from low labor and land costs (Exhibit 11). This is a high potential opportunity for the State as it requires a less skilled labor and less infrastructure investments than the other options

³⁸ Model calculated the operating costs for a 10mW data center, drawing from values supplied by Bureau of Labor Statistics (BLS), Energy Information Administration (EIA), Tax Foundation, and State websites. Assumptions: 10mW data center operating 24/7/365; Property value of \$500mn; Power Usage Effectiveness (PUE) of 1.5; Commercial electricity rate of 9.9 cents/kW-hour in WV and 7.4 cents/kW-hour; Payroll: 1 systems engineer, 3 mechanical engineers, 6 system administrators, 2 system architects, 5 security, and 2 janitors. Note: Difference does not consider potential incentives or concessions that a State can offer during negotiations.

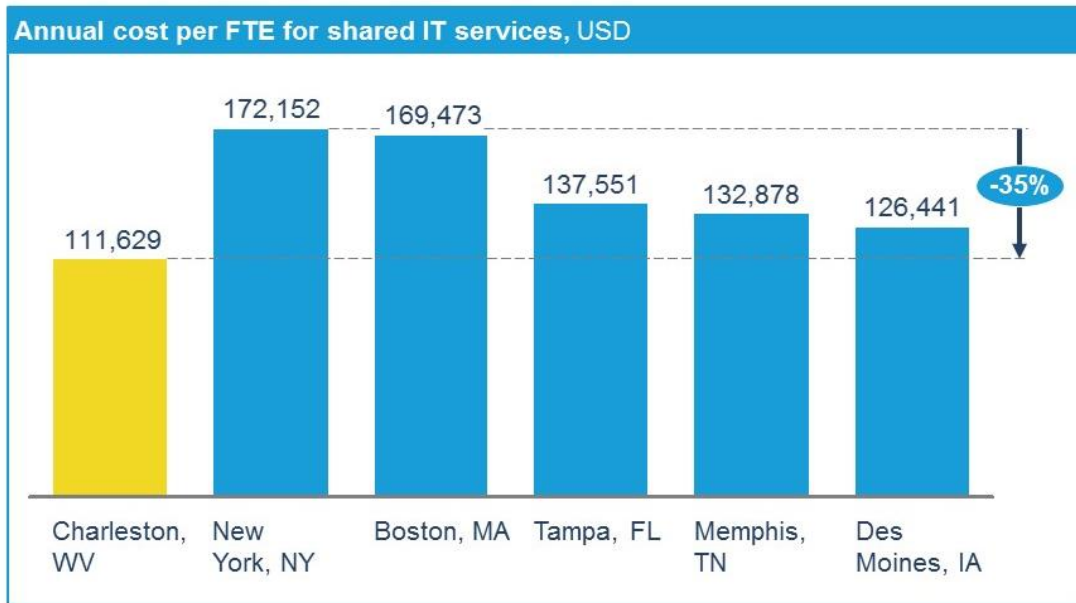


Exhibit 11: Comparative analysis of shared services cost per FTE for West Virginia and main shared services cities³⁹

4.6 LIFE SCIENCES

Life sciences is the broadly defined discipline of healthcare, medicine, and research in biology, physiology, and other subjects relevant to human health. The life sciences market is expected to add nearly \$30 billion in value over the next 5 years, growing from a ~\$50B to a ~\$80B industry⁴⁰. In addition, this sector is currently witnessing significant disruption, with technologies such as genomics expected to have a \$0.5-1.2T economic impact⁴¹.

Across the value chain from research to commercialization and production, West Virginia has assets that it can leverage such as existing clinical trials operations at universities and manufacturers. Moreover, West Virginia's location is attractive for companies and researchers given that diseases on which they are spending large proportions of total research and development (R&D) funds are prevalent in West Virginia's patient population, providing an opportunity for clinical trials and innovation (Exhibit 12).

³⁹ Modeling drew from values supplied by the Location Readiness Index.

⁴⁰ Projections based on forecasts from Markets and Markets, BCC research, and Grandview research.

⁴¹ McKinsey Global Institute report: "Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy".

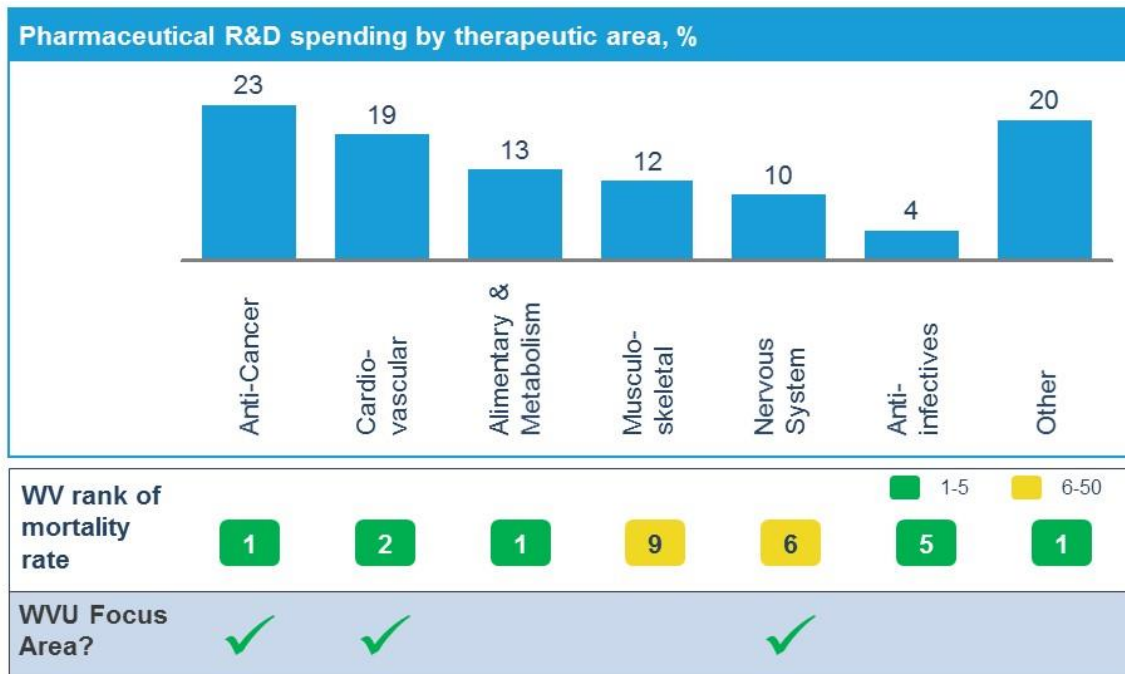


Exhibit 12: Comparison of pharmaceutical R&D spend and West Virginia disease profile⁴²

However, there are larger and more established hubs in the region against which West Virginia will have to compete (Exhibit 13), and large capital investments will be needed to further grow the State’s life sciences footprint (the Massachusetts Life Sciences Center invested or committed \$540M in the last 6 years, of which 68% went to capital projects⁴³). West Virginia also attracts less funding through the National Institutes of Health (NIH) relative to neighboring states, and has limited venture capital (VC) investment deals (Exhibit 14).

42 Pharmaceutical spend drawn from the CMR Factbook 2014, disease prevalence from data provided by the CDC and WVU Medicine.

43 Statistic from the Massachusetts Life Sciences Center 2014 Annual Report.

Distribution of innovation-enabling institutions across top clusters



Productivity of innovation hubs

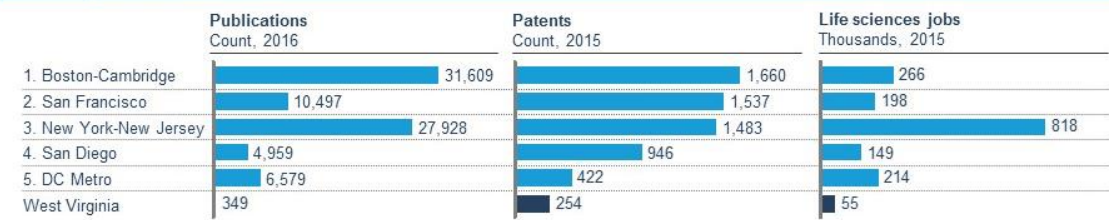


Exhibit 13: Comparative analysis of West Virginia and other major life sciences hubs in the US⁴⁴

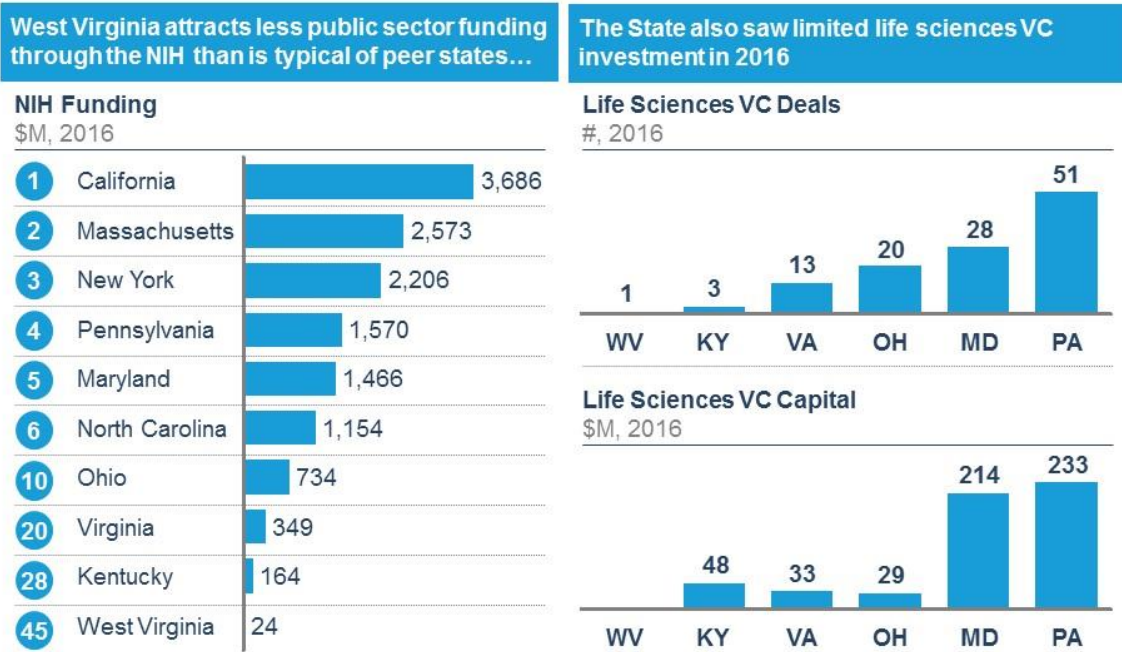


Exhibit 14: Comparison of public and private sector life sciences funds attraction for West Virginia and neighboring states⁴⁵

44 Data aggregated from PubMed; EvaluatePharma; Web of Science; Hoover's; US Patent and Trademark Office; US Bureau of Labor Statistics, Moody's analytics.

Note: number of life science establishments may not count discrete organizations and may be overestimated.

45 Venture capital funding data from Pitchbook; public sector funding from NIH reports on funding by state.

Given migration trends, West Virginia can take advantage of its relatively stable and homogenous population pool to explore opportunities for partnerships between biotech, analytics and genome sequencing companies on a population wide genome mapping project that can create a valuable data asset for biotech research that will also improve the State's health outcomes. Capturing such an opportunity will also require addressing needs of the biotech companies in terms of access to talent, patients and a supportive business environment. Specific measures West Virginia can take to address such needs include:

- Market existing research and hospital facilities, create new partnerships and expand existing ones between universities and private sector while further attracting faculty and researchers with existing patents
- Partner with local communities and academic institutions to create outreach to different population groups in the State and increase access to healthcare services (e.g., leverage Health Sciences and Technology program to reach populations in rural counties of the State)
- Actively target federal government grants that are focused on cancer, cardio-vascular disease and neurosciences
- Convene and support partnerships around genome sequencing in the State

4.7 AUTOMOTIVE ASSEMBLY PLANTS

In addition to supporting growth of the existing OEM footprint and expanding it to include manufacturing of other automotive parts, West Virginia can also consider attracting a vehicle assembly plant if the opportunity arises.

Assembly plants have been proven to bring significant economic value to a state, with Volkswagen's 2008 plant in Chattanooga, TN, bringing 3,200 jobs, \$12B in annual economic impact and \$35M per year in tax revenue, while Tesla's plant in Sparks, NV created 6,500 jobs, \$5.4B in annual economic impact and \$1.5B in tax revenues over 20 years⁴⁶. Although recent trends have been in favor of expansion of existing plants instead of relocation or creation of new ones, industry experts predict that foreign firms will be looking for new plants in the US to expand their market there.⁴⁷ For example, Hyundai announced plans for potential construction of a new US plant contingent on rising market demands⁴⁸.

Given the competition for a smaller number of opportunities with significant impact, states have actively competed to attract such plants, with incentive sizes rising since 2005 (Exhibit 15).

46 Report published by University of South Carolina School of Business.

47 Based on interviews in April, May, and June 2017 with various automotive industry experts.

48 Hyundai announcement covered by IHS Automotive; press clippings.

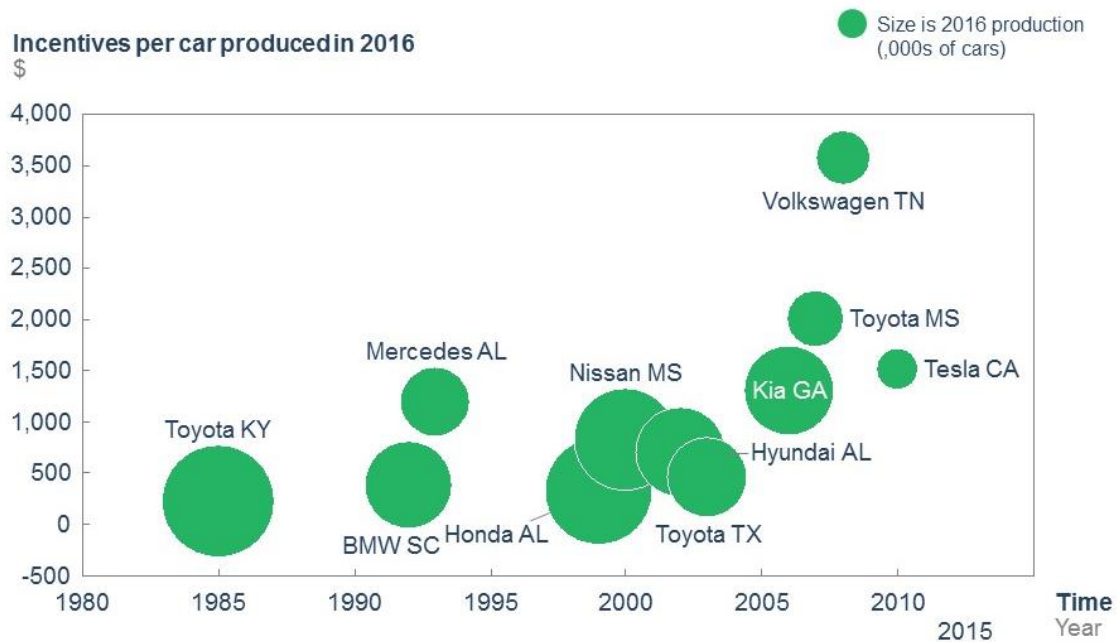


Exhibit 15: Historical trends in incentives per car produced⁴⁹

West Virginia's low labor costs and turnover, location and low cost of doing business make it an attractive place for potential new vehicle assembly plants. A comparative analysis of the economics of the recent Tesla plant in Nevada shows a potential 18% higher NPV if the plant was built in West Virginia instead⁵⁰. This difference is mostly driven by the lower labor costs in West Virginia. Moreover, current employers in the sector, such as Toyota Motor Manufacturing, West Virginia, Inc., cite the combination of the low cost while also high quality workforce as a reason for locating in West Virginia.

Successful attraction of a vehicle assembly plant will also require identification and certification of potential sites, continuing partnerships with existing OEMs, limiting the rise in utility costs and developing a competitive attraction package.

⁴⁹ IHS reports on automotive attraction deals across the US.

⁵⁰ Note: analysis does not factor in economic incentives. If the \$103 million support for site preparation is considered, the NPV gap between the two states closes to \$300 million in favor of West Virginia. Tax credits were also not included given complexity of differences between States.

5. Ease of doing business



The analysis examined **three dimensions of business climate**:

1. Business climate
2. Regulatory environment
3. Quality of life

West Virginia has historically been perceived unfavorably on the overall attractiveness of its business climate as measured by Forbes Best States for Business, the Institute for Legal Reform (ranked 50 in both), and the US News Best States Rankings (ranked 41st). However, efforts during recent years have resulted in improvements in the State’s ranking and helped create an environment perceived as more business friendly, specifically in terms of the cost of doing business and the regulatory environment. These efforts include:

- Business climate: tax reform (e.g., elimination of the business franchise tax in 2015 and reduction of the corporate net income tax rate in 2014) that contributed to West Virginia becoming a top 15 US state on its cost of doing business (Exhibit 16)
- Regulatory environment: tort reform measures that included the new modified comparative fault standard

Based on findings from interviews in the State, the effort found that West Virginia could benefit from undertaking a rebranding effort to raise awareness of its recent changes to become a more attractive business climate and to market its other assets. Businesses outside the state were not broadly aware of the recent changes.

Current tax rates					
	Corporate	Real property	Tangible personal property	Standard new employer unemployment	Supplemental wage / bonus rate
WV	6.5%	1.6%	1.6%	2.7%	4.8%
PA	9.9%	1.9%	0%	3.7%	3.1%
OH	0%	1.6%	0%	2.7%	3.5%
VA	6.0%	1.0%	4.2%	2.6%	5.8%
MD	8.5%	2.7%	2.3%	2.6%	5.8%
KY	6.0%	1.4%	0.6%	2.7%	0%

Exhibit 16: Comparative analysis of tax rates in West Virginia and neighboring states⁵¹

However, business leaders cited additional opportunities for West Virginia to further improve its business climate:

⁵¹ Tax Foundation database on state-by-state taxation policies.

1. **Business climate:** Although West Virginia's electricity costs are competitive compared to peer states (West Virginia has lower industrial electricity costs than MD and PA and is on par with VA and OH⁵²), an upward trend in industrial electricity costs has emerged over the past several years (7% annual growth in price of industrial electricity costs in last two years⁵³). This upward trend has contributed to the State's average industrial electricity price nearing the national average after historically being lower, and the State's average surpassing the national average during some months in 2017 (Exhibit 17). Though not the focus of the WV Forward effort, these trends likely can be explained by multiple factors, including reduction in electricity demand that led to loss of economies of scale, increased federal environmental regulations that contributed to rising costs of electricity generation using coal, and rising maintenance and operations costs from an aging plant fleet⁵⁴). Although 94% of the State's electricity is produced through coal, 40% of coal is imported⁵⁵), likely due to the lower cost coal options from the western United States. Moreover, West Virginia's average price may continue to be higher than other states as other states add new lower cost natural gas based power plants. Although opportunities for businesses to seek individual credits for electricity costs may exist, the recent trend was perceived as concerning by the business community inside and outside the State, when discussed in interviews. The West Virginia Forward effort will work going forward to understand more deeply the drivers of the increase in industrial electricity costs.
2. **Regulatory environment:** West Virginia is one of only 10 states⁵⁶ that still taxes business inventory as part of tangible personal property (TPP). It also taxes property and machinery, while neighboring states like OH and PA have eliminated both taxes. Although there are tax credits that could make these taxes not applicable for certain businesses, businesses and stakeholders noted that administrative process could be simplified for prospective companies, and that the presence of the taxes overall may affect the perception of the State by outside investors who are not aware of the waiver or tax credit process

52 Energy Information Administration (EIA) electricity cost data

53 Energy Information Administration (EIA) electricity cost data

54 West Virginia Public Service Commission

55 Freight Analysis Framework and Energy Information Administration (EIA) electricity cost data

56 Arkansas, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, Texas, Vermont, Virginia and West Virginia are the states that still tax business inventory (Tax Foundation, 2016).

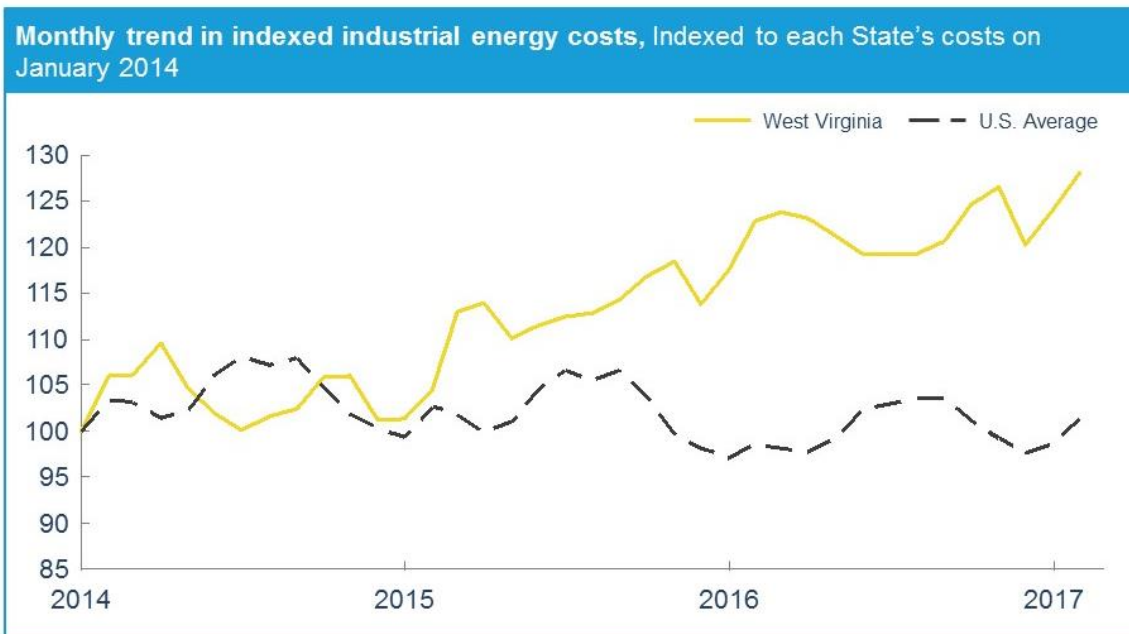
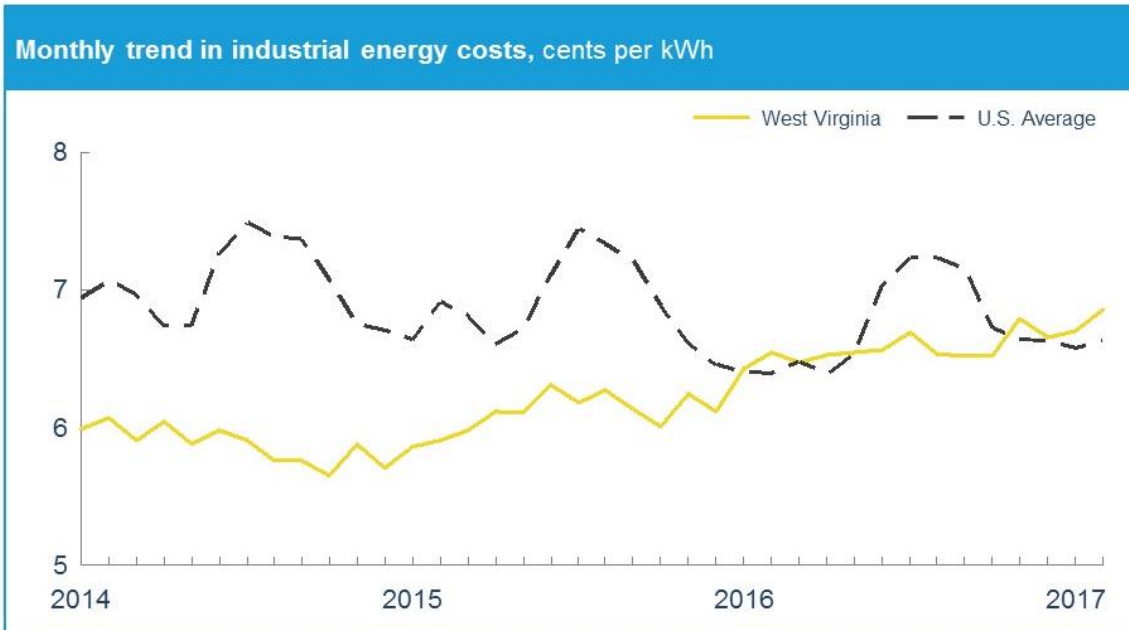


Exhibit 17: Historical trends in industrial electricity costs for West Virginia and neighboring states⁵⁷

3. **Quality of life:** West Virginia ranks unfavorably on education and health outcomes which are key markers of a region's attractiveness and quality of life (Exhibit 18). In addition, the State ranks in the bottom five on indices like the AARP Livability Index, a data-driven assessment of livability that scores State and local communities across seven categories and 40 indicators. AARP's Livability Index is a broadly used assessment, with an advisory board of leaders from

⁵⁷ Energy Information Administration (EIA) historical electricity cost data

government, philanthropy, and business, and is used by many businesses in making location decisions, by employees in choosing where to move, and by retirees in considering second homes and tourism.⁵⁸ Based on the Index's findings, there are specific opportunities to improve engagement, housing, clean air and water, transportation, and neighborhood quality in West Virginia. Working closely with local development communities could help create initiatives across the different quality of life dimensions that address existing challenges in the State. Examples can include:

- Housing: increase availability of and accessibility to multi-family units (14.2% of units are multi-family vs. 18.8% US median⁵⁹)
- Neighborhood: increase access to amenities and destinations and reduce current vacancy rates (14.3% vs. US median of 8.8%⁶⁰)
- Transportation: improve road safety (20.6 fatal crashes per 100K people yearly vs US median of 7.6⁶¹) and transportation costs (\$11.3K annual household transportation costs vs. \$10.8K US median⁶²)
- Environment: reduce exposure to contaminated water (4% of people exposed to at least one health-based violation in one year vs. 0.5% US median⁶³) and improve air quality (71.65 index of local industrial pollution vs. US median of 0; 8.1 index of regional air quality vs. US median of 8.0⁶⁴)
- Health: create concerted efforts and campaigns to encourage healthy behaviors (40% higher than median prevalence of smoking⁶⁵ and 40% lower than median access to exercise opportunities⁶⁶) and increase access and quality of healthcare (higher than

58 The Livability Index is a project of the AARP Public Policy Institute. The development of the Livability Index is led by PPI's staff experts in city planning, housing, and transportation, with research, modeling, and tool development support from ICF International and the University of Utah's Metropolitan Research Center. The index was developed with input from an interdisciplinary technical advisory committee with expertise in both policy and data analysis across the range of subject areas evaluated by the Index, including public policy, city planning, public health, aging studies, environmental sciences, and econometrics.

59 AARP Livability Index, data from US Census Bureau, 2007-2011 American Community Survey

60 AARP Livability Index, data from US Census Bureau, 2007-2011 American Community Survey

61 AARP Livability Index, data from National Highway Traffic Safety Administration, 2007-2011 Fatality Analysis Reporting System

62 AARP Livability Index, data from U.S. Department of Housing and Urban Development, 2013 Location Affordability Index

63 AARP Livability Index, data from The Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute, 2014 County Health Rankings & Roadmaps

64 AARP Livability Index, indicator measures toxicity of airborne chemicals released from nearby industrial facilities, scale from 0 to 311,000, lower values are better. Data from U.S. Environmental Protection Agency's 2011 Toxic Release Inventory, and EPA's 2013 Risk-Screening Environmental Indicators model. The median of 0 is because more than 90 percent of U.S. neighborhoods have no local industrial pollution.

65 AARP Livability Index, data from Institute for Health Metrics and Evaluation, 2012 Cigarette Smoking Prevalence in US Counties

66: AARP Livability Index, data from The Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute, 2014 County Health Rankings & Roadmaps

median healthcare professional shortage areas⁶⁷, 64% more preventable hospitalizations than US median⁶⁸)

- Engagement: increase degree of civic engagement of the population (currently <50% of eligible people vote⁶⁹)

State educational and health outcomes rankings

State	4 years enrolled in state pre-k		NAEP mathematics scores		NAEP reading scores		Adult obesity rate		Mortality Rate		Medicare quality	
West Virginia	#45	19.80%	#46	271	#42	260	#47	35.60%	#49	943.4	#47	20%
Alabama	#34	23%	#50	267	#46	259	#49	35.60%	#47	924.5	#28	58.30%
Arkansas	#20	25.10%	#44	275	#45	259	#45	34.50%	#45	901.8	#48	10.90%
Florida	#12	26.30%	#42	275	#32	263	#16	26.80%	#6	662.9	#16	79.20%
Georgia	#10	26.60%	#36	279	#37	262	#31	30.60%	#38	808.1	#31	56.50%
Kentucky	#39	21.80%	#39	278	#19	268	#46	34.60%	#48	924.7	#43	25.10%
Louisiana	#9	26.80%	#49	268	#48	255	#50	36.20%	#43	874.2	#44	23.30%
Mississippi	#15	25.60%	#48	271	#50	252	#48	35.60%	#50	963.7	#45	21.10%
North Carolina	#41	21.60%	#30	281	#39	261	#29	30.10%	#37	789.9	#29	58.20%
South Carolina	#43	20.80%	#40	276	#40	260	#38	31.60%	#42	840	#40	43.10%
Tennessee	#42	21.60%	#37	278	#30	265	#42	33.70%	#44	886.4	#30	56.80%
Virginia	#26	24.30%	#8	288	#25	267	#22	29.10%	#19	721.6	#38	46.20%
New Hampshire		30%		297		274		22.60%		558.2		78.20%
Southeast		24.28%		277		262		31.03%		798.4		65.01%
National		24.67%		281		264		28.85%		734.1		73.04%

Exhibit 18 – Ranking of US States by educational and health outcomes⁷⁰

⁶⁷ AARP Livability Index, indicator measures severity of clinician shortage, scale from 0 to 25, lower values are better; data from Health Resources and Services Administration, 2014 Health Professional Shortage Area Data Warehouse.

⁶⁸ AARP Livability Index, indicator measures number of hospital admissions for conditions that could be effectively treated through outpatient care, lower values are better; data from the Dartmouth Institute for Health Policy & Clinical Practice, 2011 Dartmouth Atlas of Health Care.

⁶⁹ AARP Livability Index, data from U.S. Election Assistance Commission, 2012 Election Administration and Voting Survey.

⁷⁰ US News & McKinsey Leading States Index; pre-K enrollment data from US census American Community Survey; math and reading scores data from National Center for Education Statistics; obesity data from CDC Behavioral Risk Factor Surveillance; mortality data from CDC Wonder; Medicare data from Center for Medicare Services.

6. Innovation and Business Development

The background image is a landscape photograph. In the foreground, there are large, light-colored, textured rocks, possibly granite or limestone, with some dark spots. Behind the rocks, there is a dense forest of evergreen trees, likely spruce or fir, extending to the horizon. The sky is a clear, bright blue. The overall scene is a natural, outdoor setting.

To understand the opportunity in innovation and business development, analysis focused on **three dimensions**:

1. Attraction of businesses from outside the State
2. Support available for growing existing small businesses
3. Environment for creation of new businesses.

6.1 BUSINESS ATTRACTION

West Virginia receives 0.1% of total Foreign Direct Investments (FDI) to the United States⁷¹, even though it has roughly 0.5% of the national population. There are several possible explanations for this imbalance, including:

- West Virginia has fewer discretionary funds than other states to use in business attraction negotiations, with the bulk of its incentives coming through future tax credits vs. upfront support
- While the Development Office has had success in attracting several landmark projects to the State in recent years⁷², it is currently under-resourced in its ability to act as a full-service investment promotion agency in comparison to peer states. This has forced the office to be more reactive to attraction opportunities vs. actively targeting outreach to priority areas for the State
- Lack of sites pre-certified for development has limited West Virginia's ability to offer a competitive product to prospective investors

Three actions that West Virginia could consider to address those challenges, support the capabilities of the office and increase its competitiveness in attracting investments:

- Expand the role of the West Virginia Development Office so it can more actively create an attraction strategy, develop a competitive product, identify and actively outreach to target companies and support them through the execution process
- Consider changing the mix of incentives available for investment attraction towards more upfront support vs. tax credits, thus allowing for more discretionary spend vs. statutory
- Launch a site certification program that identifies potential sites, assess their current status is infrastructure needs, and estimates the investment required to prepare them. Over the long run, West Virginia can also consider a site development investment fund or investment approach to help increase the inventory of ready sites for priority sectors

⁷¹ Ranking and data from FDI Markets 2011-2015.

⁷² Location Notebook: West Virginia's Economic Diversification Helping the State to Meet Challenges, Area Development, Q3 2016.

6.2 SMALL BUSINESS SUPPORT

Small businesses (defined as businesses employing less than 500 employees⁷³) are important economic actors in the State. Over half of the private workforce in West Virginia is employed by small businesses, which account for 98.9% of all businesses in the State⁷⁴. They also are over-indexed in counties with less fortunate economic status, which makes their support an important lever for inclusive growth. However, business exits have been rising, offsetting the gains created from the birth of new businesses (Exhibit 19).

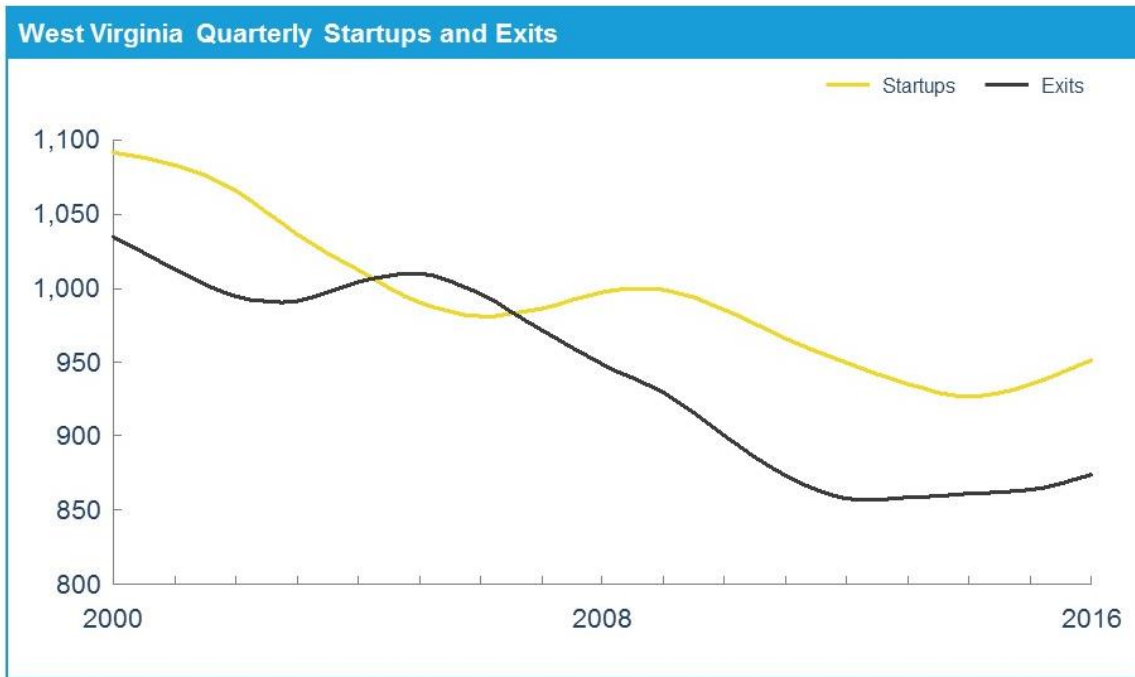


Exhibit 19: Trends in startups creation and exits in West Virginia⁷⁵

Many of the challenges to small business growth in West Virginia are due to the fact that small businesses are not fully aware of the resources at their disposal to grow and succeed. In addition, there is a lack of business support services across different topics, e.g., financial forecasting and literacy resources, affordable, technical business operations such as accounting, ecommerce and web design, affordable, vetted legal services in general business and intellectual property (IP). Access to resources would help companies plan ahead and adapt to changing business needs.

Different actions that West Virginia could consider to address those challenges include:

- Creating a one-stop shop that can map current resources and business needs, direct businesses to the right entities and identify white space in support resources⁷⁶
- Considering partnership between the West Virginia Small Business Development Center and universities to offer shared services support to small businesses such as:

⁷³ Based on the definition of the US Small Business Administration.

⁷⁴ Data reported by the Small Business Administration (SBA).

⁷⁵ Data reported by the Small Business Administration (SBA).

⁷⁶ Expert interviews, international examples, research from the World Bank

- Leveraging law schools to provide advice on legal issues, succession planning and intellectual property rights
- Leveraging business schools to offer technical assistance in topics like accounting, financial forecasting services, and fact gathering and sharing on industry trends and best practices

6.3 FOSTER CREATION OF NEW BUSINESSES

Although the whole region has struggled with attracting investment funds for startups, West Virginia has particularly struggled relative to neighboring states (Exhibit 20). It ranks 49th in the percent of the adult population in an area that became entrepreneurs on a given month⁷⁷, it receives fewer Small Business Innovation Research (SBIR) awards than peer states⁷⁸, and ranks in the bottom five in terms of business birth⁷⁹ and patents per capita⁸⁰. West Virginia also receives fewer venture capital (VC) investments, with no funds available for early stage VCs⁸¹.

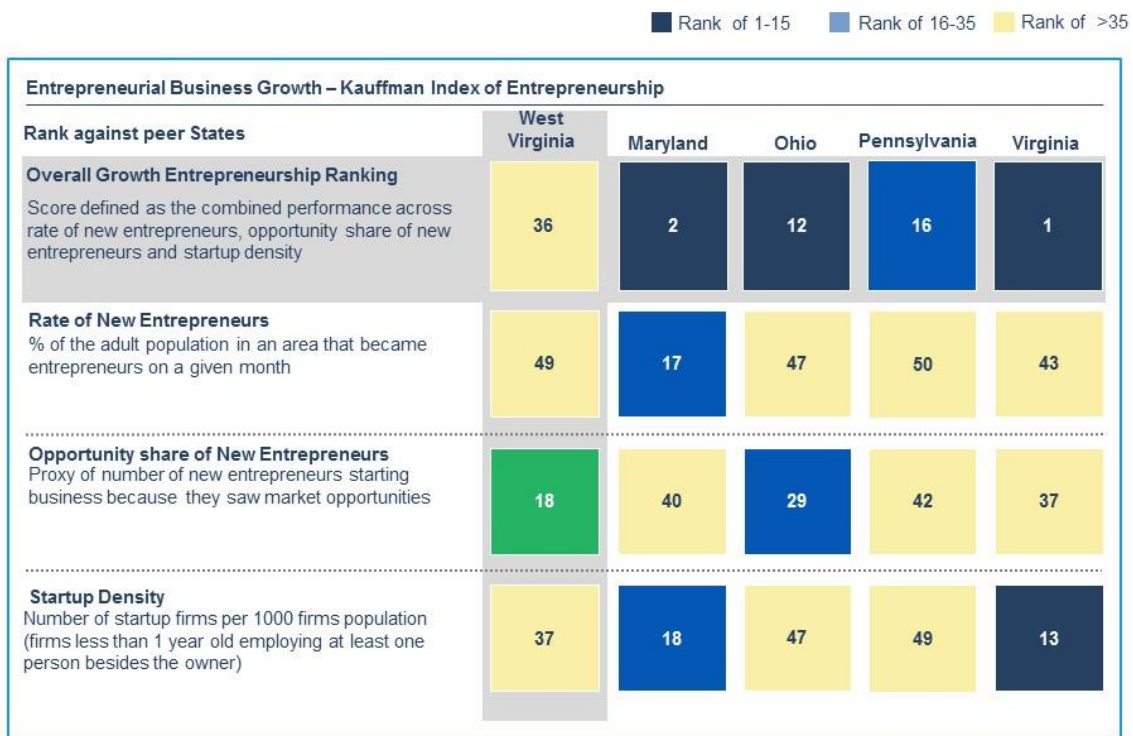


Exhibit 20: State ranking on entrepreneurial business growth⁸²

⁷⁷ Rankings published in the Kauffman Growth Entrepreneurship Index 2016, and Kauffman Index of Startup Activity 2016.

⁷⁸ Rankings published by the National Science Foundation, Science and Engineering Indicators

⁷⁹ US Bureau of Labor Statistics, 2015

⁸⁰ US Patent Office, 2015

⁸¹ Pitchbook data on venture capital deals, 2016.

⁸² Kauffman Growth Entrepreneurship Index 2016, Kauffman Index of Startup Activity 2016

These challenges can be explained by lower research and development (R&D) investments than peers⁸³, a smaller startup pipeline offering limited investment opportunities for VC fund and a fragmented startup support ecosystem. In fact, business incubators and accelerators are fragmented and spread across the State, with each offering specific services and competing with the others for a small pool of operational and investment support.

In order to better direct the State's strategy, increase collaboration between existing organizations and better attract VC funding to the State, the State can consider:

- Create an Innovation Council that sets strategy and coordinates efforts by convening the existing network of innovation-focused organizations, corporations, financiers, and policymakers active in West Virginia and located in the State
- Increase small business operational and grant application support to receive more SBIR awards
- Create a "Startup Catalyst" initiative to increase VC funds and technical assistance to support seed and early stage startups, and
- Attract more funding for supporting startups, as West Virginia is particularly lacks early-stage funding, which contributed to a ranking of 49th out of 50 for the rate of new businesses born in the State⁸⁴.

⁸³ West Virginia receives less R&D investment than its peer states (\$190K vs. \$2-4M for MD, PA, OH, VA) across nonprofits, government, business, and institution funds based on data from the National Science Foundation and National Center for Education Statistics' Higher Education Research and Development Survey.

⁸⁴ US Bureau of Labor Statistics, 2015

7. Infrastructure

A blue-tinted landscape photograph. In the foreground, a large, dark, craggy rock formation dominates the left side, extending towards the center. The rock has a rough, textured surface with visible cracks and shadows. Beyond the rock, a valley filled with dense green vegetation stretches towards the horizon. In the distance, rolling hills or mountains are visible under a clear, light blue sky. The overall mood is serene and natural.

The analysis considered opportunities in transportation, IT, and site infrastructure:

- There is an opportunity to improve transportation indicators, as road and bridge quality lags behind peers (ranked 37th in road quality and 43rd in number of deficient bridges⁸⁵)
- Despite past efforts, West Virginia ranks in the bottom 10 for households with access to broadband⁸⁶, with majority of West Virginians not satisfied with connection costs (73%), speed (58%) or reliability (60%)⁸⁷. Improving broadband access can create \$1.9B in value from direct and indirect economic impact⁸⁸
- Dual broadband access is also important for industries such as data centers, and West Virginia can increase attractiveness of the State for those industries by enduring potential data center target sites have sufficient broadband connectivity (Exhibit 21)

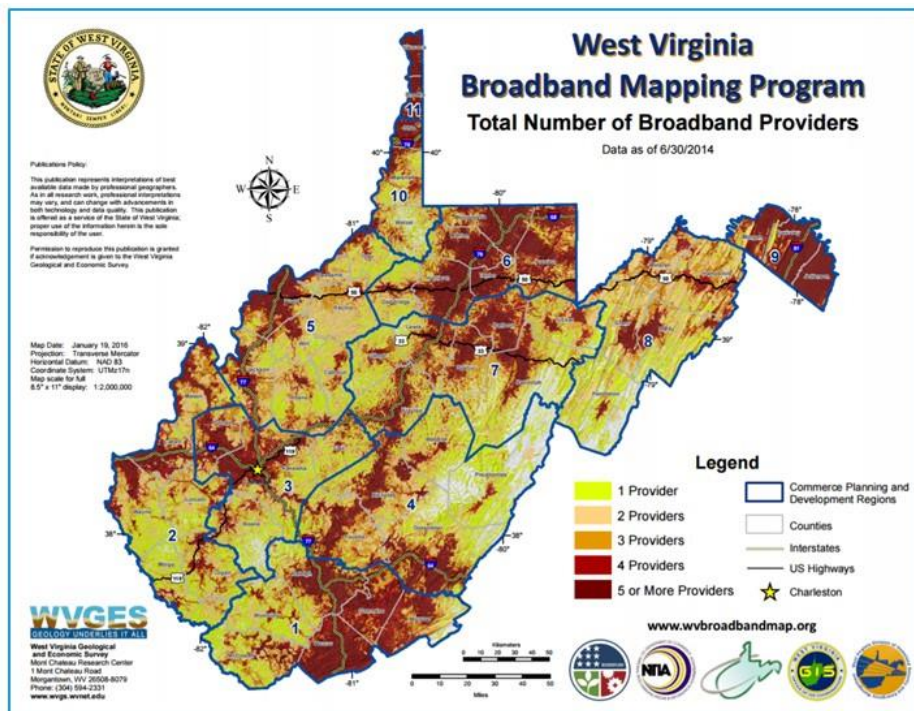


Exhibit 21: Mapping of West Virginia broadband coverage based on number of providers⁸⁹

- Compared to neighboring states, West Virginia has fewer sites available for prospective companies (225 vs. 1K+ in OH, VA and PA⁹⁰), and there currently is no site certification and remediation program to define development ready locations in the State.

⁸⁵ US Department of Transportation data on deficient bridges.

⁸⁶ Calculated from US Census Bureau's data on broadband access.

⁸⁷ Surveys conducted by Generation WV, and Broadband Now

⁸⁸ Estimates provided by West Virginia State University

⁸⁹ West Virginia Geological and Economic survey

⁹⁰ This comparison was conducted using data from the flatness of US States, and public data from State Economic development agencies.

In addition to launching a site certification program (reference Section 6.1), West Virginia can consider exploring innovative financing mechanisms that leverage private sector financing to fund capital-intensive projects that can help remediate transportation infrastructure:

- For assets that can be profitable at or below market price, West Virginia can consider attracting private sector companies to build and operate the asset
- For unprofitable assets, West Virginia can consider options that can help make investment more attractive to the private sector:
 - Direct government funding or lending (e.g., subsidies, grants)
 - Government borrowing (e.g., bonds, Transportation Infrastructure Finance and Innovation Act (TIFIA))
 - Government guarantees (e.g., debt guarantee, collateral provision)
 - Shared equity through public-private partnerships

Government support would require incremental funds that can be used under any form of financing. These revenues could come from three different sources:

- Tax-based revenues, specifically focusing on sin taxes
- User-based revenues such as direct user fees (toll roads, membership fees)
- Monetization of existing State assets (e.g., parking lots, buildings, roads)

A spectrum of available program designs exists, each of which involves different levels of institutional support and available funding. At the most basic level, the State could compile a database of the sites that are best suited for particular industries or applications, along with cost estimates of the level of investment that would be required to make them operational. If the site certification initiative is to be more comprehensive, for instance by covering a portion of the investment to remediate the sites, the State can consider financing through Tax Increment Financing (TIF) vehicles in order to meet the greater investment needed to meet these needs.

The Legislature recently passed House Bill 3093 to foster broadband access in rural areas through debt guarantees, and the government can leverage this law to maximize the support provided to broadband co-operatives.

8. Human Capital



Investments in improving human capital were considered the most significant opportunity for improvement in West Virginia, especially because access to a specialized workforce is a significant factor for investment attraction in the sectors targeted for growth. The analysis considered **three primary dimensions of human capital**:

- West Virginia’s future talent pool
- The health and skills of the current workforce
- The ability of companies in West Virginia to recruit talent from outside

West Virginia’s level of educational attainment, and particularly the volume of STEM graduates per year is lower than surrounding states (14% STEM graduates vs. 18.5% in VA and 23% in MD)⁹¹ (Exhibit 22). Given the fact that positions that are hardest to fill by employers are in the majority STEM occupations, there is an opportunity to better match labor demand and supply in the State

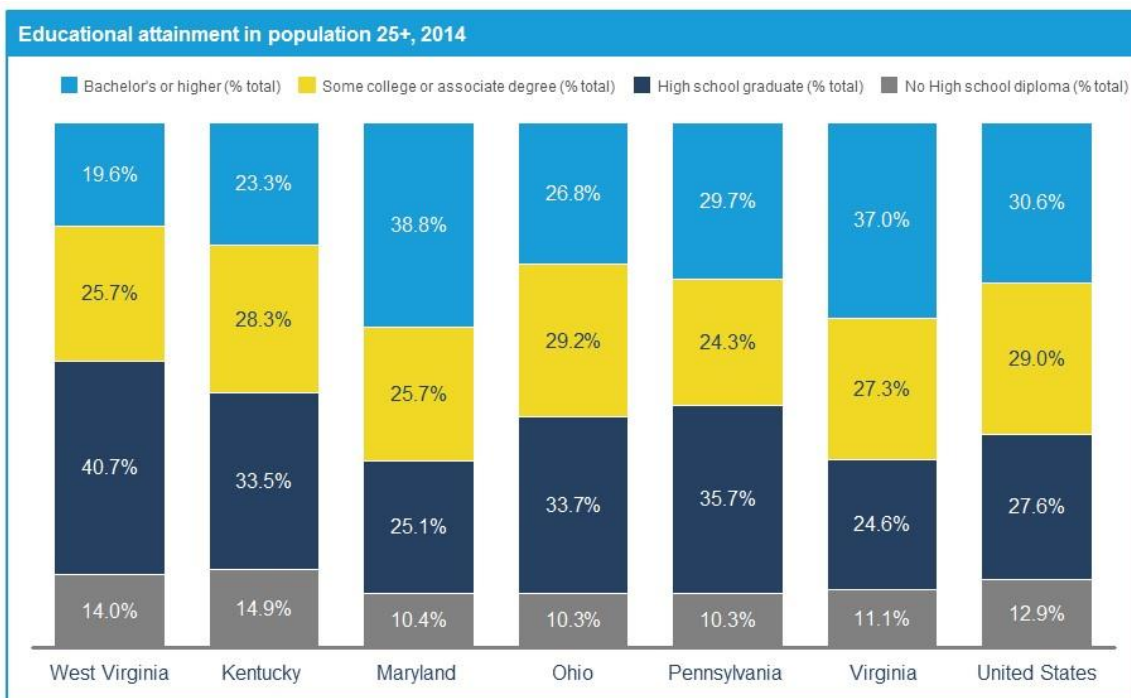


Exhibit 22: Breakdown of educational attainment levels for populations aged 25+ in West Virginia and neighboring states⁹²

Labor force participation has been declining, and less than half of working-age people are actively seeking employment in some counties of the State (Exhibit 23). Similarly, unemployment is higher than in neighboring states (Exhibit 24)

⁹¹ National Center for Education Statistics, 2014

⁹² Moody’s analytics, 2014

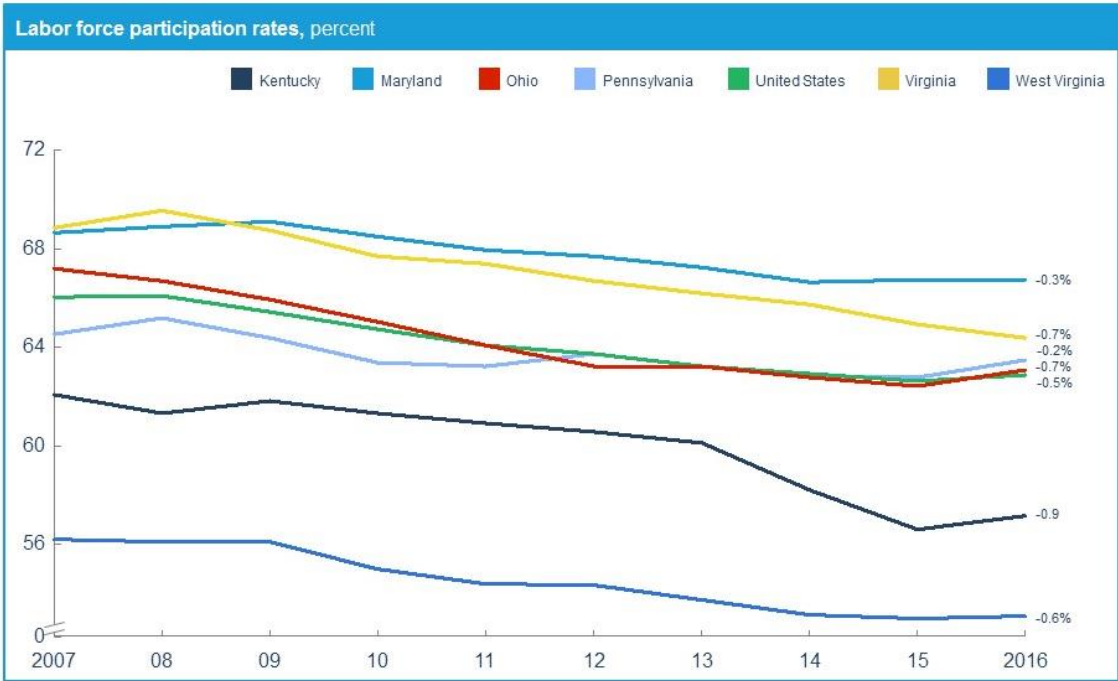


Exhibit 23: Trends in labor force participation rates in West Virginia and neighboring states⁹³

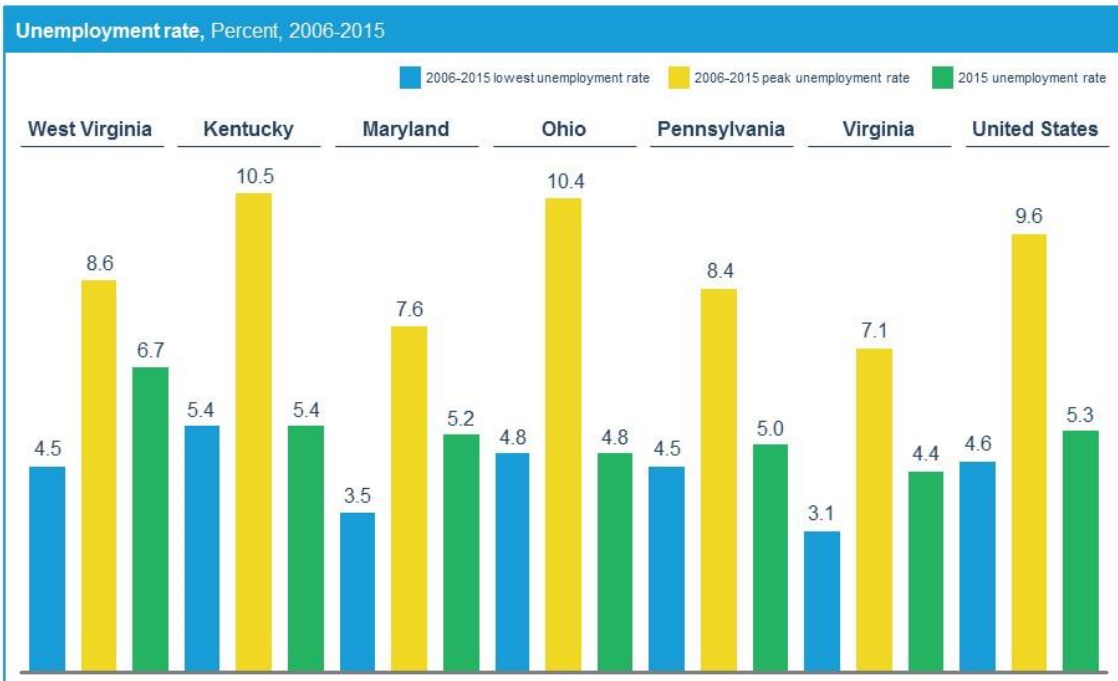


Exhibit 24: Trends in unemployment rates in West Virginia and neighboring states⁹⁴

⁹³ Labor force participation rates, Moody's Analytics 2007-2016

⁹⁴ Unemployment rates, Moody's Analytics 2006-2015

Four drivers likely explain those trends:

- Among neighboring states, West Virginia has the highest percentage of population with a disability (22%) and the highest percentage of them out of the labor force (80%) (Exhibit 25).

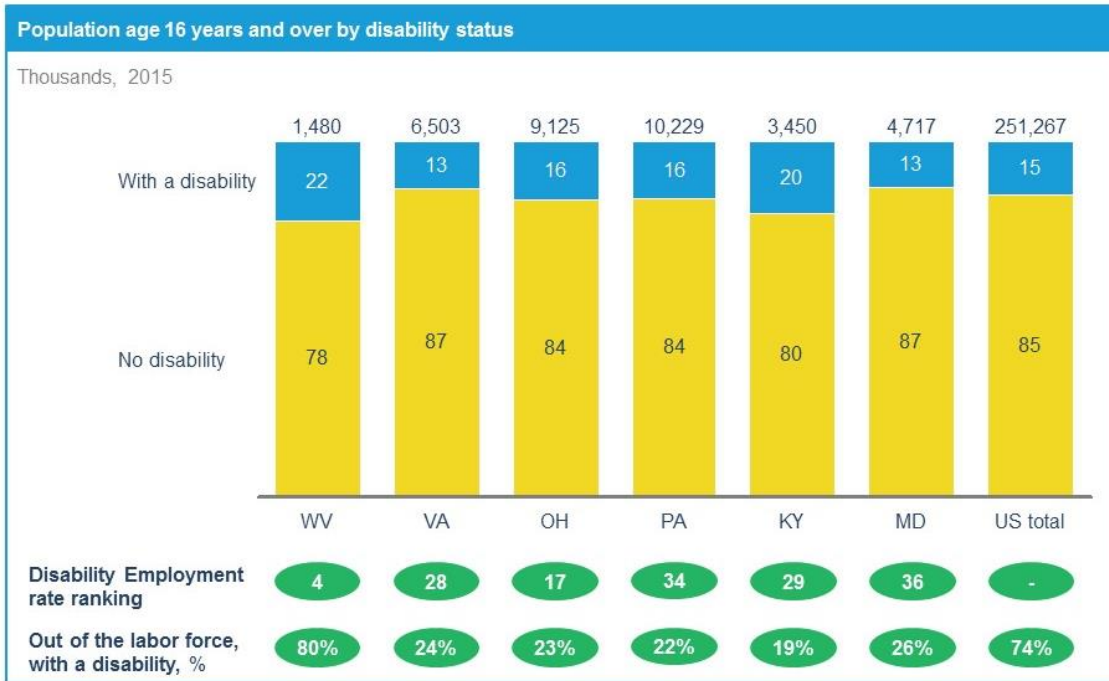


Exhibit 25: Disability rates and employment status in West Virginia and neighboring states⁹⁵

- West Virginia also has the lowest percentage of women participation in the labor force (62%) across all US states (Exhibit 26)

⁹⁵ US Census Bureau , American Community Survey 1 year estimates

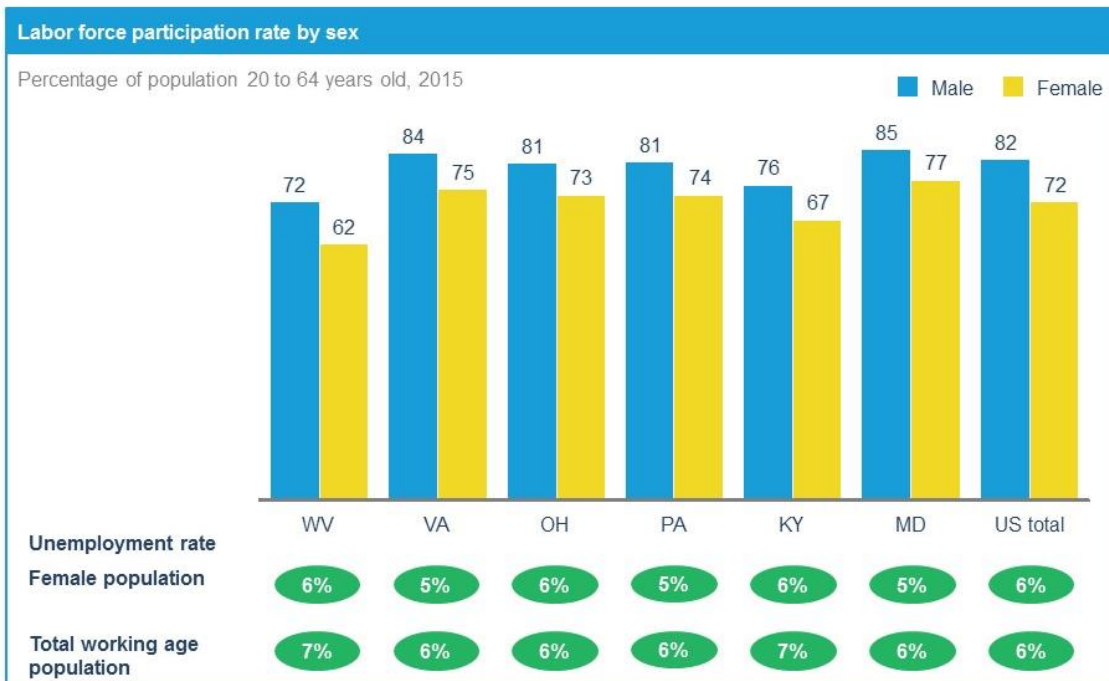


Exhibit 26: Labor force participation rate by sex in West Virginia and neighboring states⁹⁶

- There is a mismatch between labor supply and demand, with employers reporting that it is necessary to hire people from out of state for occupations such as nursing, because unemployed workers are not receiving support and retraining to fill positions in growing industries
- The opioid crisis has affected the ability of a large portion of the population to participate in the job market. In fact, between 2013 and 2015, West Virginia has witnessed a 47% increase in the prevalence of deaths from drug overdose, which is currently the highest in the nation and around 2.5 times higher than the national average (32.4 drug-related death per 100 thousand residents vs. national average of 13.5)⁹⁷

Large waves of out-migration over the past three years⁹⁸ have further contributed to a shrinking population and to the loss of talent that was driven by limited job opportunities in sectors such as IT

Ongoing efforts exist to address these challenges across the State, specifically in relation to increasing workforce participation, but there may be an opportunity to unite and consolidate these efforts under one umbrella that channels resources into human capital priorities for the State in a more coordinated manner. Such a taskforce could bring together the education providers, major employers, and existing institutions working within the human capital space across West Virginia to identify and launch an integrated strategy that address existing challenges to the labor force. Potential activities under each human capital dimension could include:

⁹⁶ US Census Bureau , American Community Survey 1 year estimates

⁹⁷ West Virginia Economic Outlook 2017-2021 – Bureau of Business and Economic Research at WVU College of Business and Economics; America’s Health Rankings

⁹⁸ Moody’s analytics, based on 2015 migration data from the Census Bureau

- To build its future talent pool
 - Increase STEM focus in secondary education by segmenting youth into specific tracks and emphasizing education to employment curricula
 - Expand the State’s role in vocational training by identify priority occupations and channeling students there, collaborating with the private sector and improving training quality
 - Support STEM in post-secondary education through sector specific curricula, innovative models to increase capacity and affordability of vocational training, attraction and retention of talented faculty
- To improve health and skill of existing workforce:
 - Take specific actions for prevention, early intervention and treatment of affected citizens
 - Increase labor force participation and reduce unemployment through more inclusive work environments (focusing on measures that can increase women participation), considering incentives that can encourage return to employment, and retraining unemployed workers in hard to fill occupations that are very similar in skills to their previous job
- To attract talent from outside West Virginia:
 - Better engage university alumni communities through outreach and initiatives to incentivize return to the State
 - Take measures to improve quality of life through long term, sustainable investments in improving quality of air and water, healthcare and transportation in the State

9. Success Factors for Implementation

The background image is a landscape photograph. In the foreground, there is a dense forest of tall, dark green evergreen trees. Behind this forest, a wide, open field of green vegetation, possibly a meadow or a young forest, stretches towards the horizon. The sky is a clear, bright blue. The overall scene is peaceful and natural.

In order to make West Virginia Forward successful, West Virginia Forward can learn from best practices from other states, as well as previous experience from other initiatives. In fact, past experience has shown that successful implementation will require strong leadership, ensuring all stakeholders have buy-in, and targeted focus on well-defined projects with specific scope. At the same time, experience from other states has shown that successful economic development initiatives can create significant impact (e.g., 100K+ new jobs and \$6.3B investments in Columbus since 2010, \$500+M in venture capital funding raised in one year in Atlanta⁹⁹), as long as initiatives rely on effective and early stakeholder engagement, implementation plans that include clear milestones and targets, clear owners for each activity, and effective monitoring and tracking of progress. As West Virginia Forward’s partners pivot toward taking joint and individual action against the findings of this effort, there are three main questions that partners would want to address:

- How will initiatives be designed and implemented?
- What is the structure that will drive execution?
- How will relevant stakeholders be effectively engaged?

9.1 HOW WILL INITIATIVES BE DESIGNED AND IMPLEMENTED?

Across the full set of options for consideration, each major stakeholder in this effort (i.e., West Virginia University, Department of Commerce, and Marshall University) will have a role in implementation (Exhibit 27), with some actions driven individually and others via coordinated effort across the three entities and with organizations beyond.

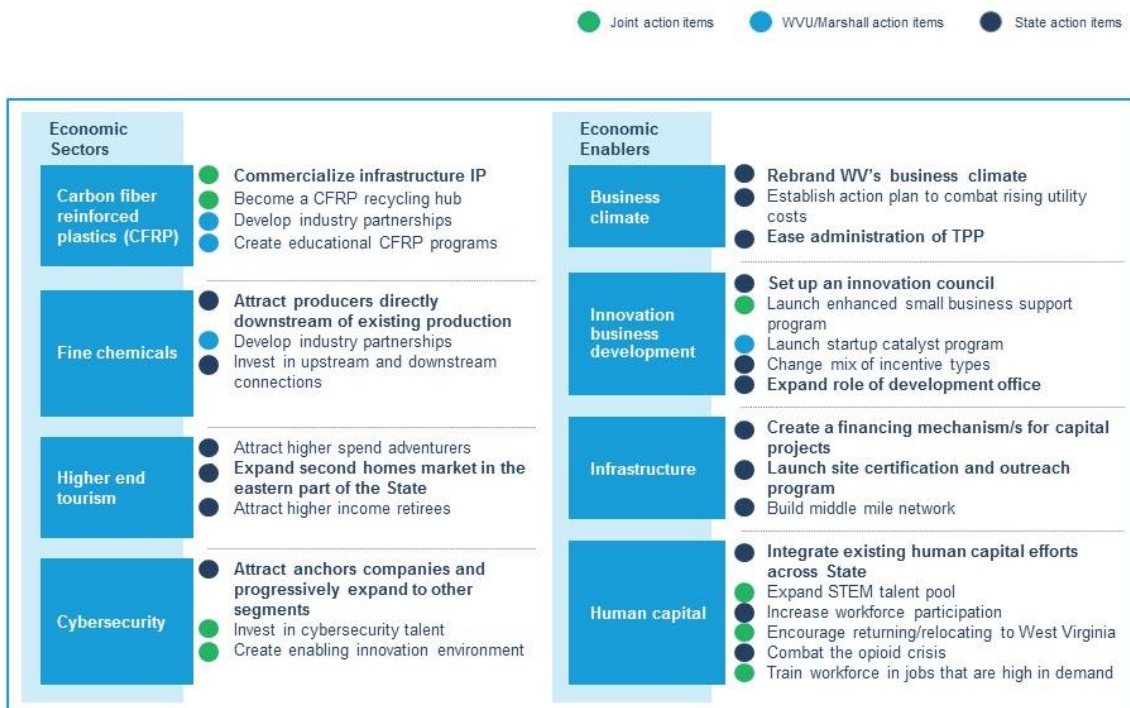


Exhibit 27: Summary of opportunities identified

⁹⁹ Publicly available data on each organization’s website.

Given that, each major stakeholder will work to define a set of initiatives that they can drive forward, based on their capabilities, mandate and resources. As an example, WVU can consider focusing on four key initiatives (Exhibit 28).

	Objective/aspiration
Innovation and R&D leadership	<ul style="list-style-type: none"> Develop an enriching innovation environment for students, faculty, and local startups that effectively generates and commercializes the University's intellectual property
Local business support	<ul style="list-style-type: none"> Offer business and legal support services to small businesses in partnership with the State Commerce Department
Talent expansion	<ul style="list-style-type: none"> Create the educational programs required to expand the talent pipeline for West Virginia, especially in new sectors that will diversify the economy such as advanced materials, cybersecurity and life sciences Partner with leading firms in diversification sectors (e.g. cybersecurity, advanced materials, life sciences) to develop tailored training programs that meet their human capital needs and offer exit opportunities for university graduates
Alumni outreach	<ul style="list-style-type: none"> Establish connections with university alumni across the country in order to create business partnerships, attract investments as well as talent back to the state

Exhibit 28: Example initiatives for WVU

Each initiative could cover a specific set of opportunities (Exhibit 29).



Exhibit 29: Breakdown of opportunities for each WVU initiative

As each initiative will require different degrees of collaboration, an effective governance mechanism that allows each stakeholder to drive their own action items while effectively coordinating on overlapping topics will be important.

9.2 WHAT IS THE STRUCTURE THAT WILL DRIVE EXECUTION?

Initiatives will have the greatest chance of success if there is a governance authority that ultimately owns the strategic plan and can work to coordinate actors across West Virginia to drive it towards implementation. As such, WVU, the Commerce Department, and Marshall University will sign a memorandum of understanding (MOU) that formalizes the partnership through commitments from each signatory on cooperation, implementation of specific initiatives and resources dedication. The MOU will help create a structure of accountability for all signatories.

To help ensure effective cooperation, two governing entities could be created:

- A convening unit to manage process, track and drive progress of the various initiatives against targets, identify and convene potential implementation partners for each initiative
- A steering committee that includes leadership from each signatory (e.g., WVU and Marshall University Presidents, Commerce Secretary). The Committee is tasked in setting overall direction, prioritizing initiatives, and directing stakeholder outreach

9.3 HOW WILL RELEVANT STAKEHOLDERS BE EFFECTIVELY ENGAGED?

A diverse group of stakeholders across West Virginia can be involved at different stages of the project to get input, buy-in, and partnership on implementation (Exhibit 30).

Stakeholder group	Organizations	Nature of involvement	Risks	Major concern
Legislature	<ul style="list-style-type: none"> ▪ House ▪ Senate 	<ul style="list-style-type: none"> ▪ Key influencer and partner on policy related topics 	<ul style="list-style-type: none"> ▪ Expect to be engaged and provide input ▪ Will seek alignment with policy agenda 	<ul style="list-style-type: none"> ▪ Local constituents ▪ Public perception
Executive	<ul style="list-style-type: none"> ▪ Governor ▪ Commerce 	<ul style="list-style-type: none"> ▪ Decision maker ▪ Implementation partner 	<ul style="list-style-type: none"> ▪ Will look for alignment with own priorities ▪ Expects to be engaged during process 	<ul style="list-style-type: none"> ▪ Local constituents ▪ Public perception ▪ Advancing own objectives
Private sector	<ul style="list-style-type: none"> ▪ Chamber of Commerce ▪ Investors & VCs 	<ul style="list-style-type: none"> ▪ Influencer ▪ Potential implementation partner 	<ul style="list-style-type: none"> ▪ Can have vested interest in sector focus ▪ Will want to be involved in questions on business climate 	<ul style="list-style-type: none"> ▪ Profitability of business
Vocational/ educational organizations	<ul style="list-style-type: none"> ▪ Community and technical colleges ▪ Private universities ▪ Workforce WV ▪ K12 schools 	<ul style="list-style-type: none"> ▪ Implementation partner 	<ul style="list-style-type: none"> ▪ Will want to weigh in and be involved in human capital recommendations ▪ Important to get buy-in to partner in implementation 	<ul style="list-style-type: none"> ▪ Funding from state ▪ Enrollment
Other	<ul style="list-style-type: none"> ▪ ARC ▪ TechConnect ▪ National Guard ▪ Economic development NGOs 	<ul style="list-style-type: none"> ▪ Implementation partners 	<ul style="list-style-type: none"> ▪ Important to get buy-in in order to leverage their resources in implementation 	<ul style="list-style-type: none"> ▪ N/A (depends on organization)

Exhibit 30: Stakeholder analysis

Effective and timely engagement of stakeholders will be key for the success of this project, as it will allow for the creation of partnerships for implementation of specific initiatives. A preliminary engagement plan has been developed during this project, which will be updated to reflect how best to engage each stakeholder on specific action items based on their mandate, capabilities, and capacity to dedicate to this effort (Exhibit 30).

10 Conclusion

West Virginia Forward has formulated a strategic plan to diversify West Virginia's economy by identifying growing sectors that the State could move to capture, as well as highlighting areas of strength and providing insight into how to address opportunities for improvement across economic enablers. In doing so, West Virginia Forward identified clear action items for West Virginia to pursue over the short and long term to create momentum, grow and diversify the economy, and create new job opportunities for its citizens. West Virginia Forward builds on the State's unique assets and areas where West Virginia outperforms its neighboring states, thus offering an attractive value proposition for potential businesses.

West Virginia Forward's implementation presents an opportunity to reverse the economic fortunes of the State and create momentum around a more diverse and resilient economy. Effective implementation will be a key determinant of such a success, and will rely on ensuring the required governance structure, partnerships, and stakeholder engagement processes are in place to achieve these aspirations.

Through the MOU, WVU, Marshall University, and the State Department of Commerce are committed to ensuring successful implementation by undertaking specific actions aligned with the strategy, starting in fall of 2017. Recent successes, like upticks in tourism and recent new investment deals signed, are just the beginning of what is to come from the work.

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