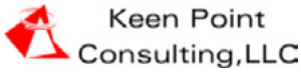
WEST VIRGINIA
Higher Education
Policy Commission

VISION 2030

West Virginia Science & Technology Plan



The development of Vision 2030: West Virginia Science & Technology Plan 2030 was led by Jennifer Ozawa and Shannon Wells at RTI International in collaboration with the West Virginia Science, Technology, and Research Division of the West Virginia Higher Education Policy Commission and the Executive Committee of the West Virginia Science and Research Council. Anthony Gillespie served as a senior advisor. Adams Bailey, Carly Dotson, and Tiger Fawaz of RTI supported research, data collection, and analysis. Lisa Gardner created the report design, and Christina Rodriguez was the editor. The plan was adopted by the West Virginia Science and Research Council on June 27, 2025.

West Virginia Science and Research Council

Sarah Armstrong Tucker, PhD, (Chair), Chancellor, West Virginia Higher Education Policy Commission
Jason Best, PhD, Assistant Vice President for Strategic Planning and Institutional Effectiveness, Shepherd University
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Juliana Serafin, PhD, Director Emeritus, Science, Technology and Research Division, West Virginia Higher Education Policy Commission

Note: This list of West Virginia Science and Research Council members and positions held by members reflect the December 2024–June 2025 period during which the planning process was conducted.

Executive Committee

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WEST VIRGINIA
Higher Education
Policy Commission

Michael Farrell, *Chair*
Sarah Armstrong Tucker, Ph.D., *Chancellor*

July 7, 2025

It is my honor to present the *Vision 2030 Science and Technology Plan* on behalf of the West Virginia Science and Research Council. This plan represents not only a forward-looking strategy, but also a firm commitment to building a brighter future for our state through the advancement of science, technology, research, and innovation.

West Virginia has long been defined by the strength, creativity, and resilience of its people. As we look to the decade ahead, *Vision 2030* offers a blueprint to harness that strength by investing in our students, supporting our researchers, and accelerating partnerships that drive discovery and economic opportunity. It is a call to action for higher education, industry, and government to come together to foster a more vibrant, innovative, and inclusive economy.

The goals outlined in this plan are ambitious—and they should be. From improving STEM education at all levels to expanding research capacity and cultivating technology-driven business growth, *Vision 2030* is designed to ensure West Virginia remains competitive in an ever-evolving global economy. At its core, this plan is about people: preparing our students for high-demand careers, supporting our faculty in their groundbreaking work, and positioning our communities to thrive.

I want to thank the dedicated members of the Science and Research Council along with the Science and Technology Plan Executive Committee, and all those who contributed their time, insights, and expertise to shape this vision. Your work ensures that West Virginia continues to lead with bold ideas and collaborative spirit.

Sincerely,

Sarah Armstrong Tucker, Ph.D.
Chancellor

Table Contents

Executive Summary

Vision 2030 is West Virginia' statewide science and technology (S&T) plan. It is an update of the previous five-year plan, Vision 2025. The Plan is used to identify high-priority S&T research areas of strategic significance to the state and to align stakeholders around priorities that advance West Virginia's research enterprise and industry growth. It calls on West Virginia to redouble its efforts and to move forward in advancing the role of science and technology education, research, and innovation in its economy.

Vision

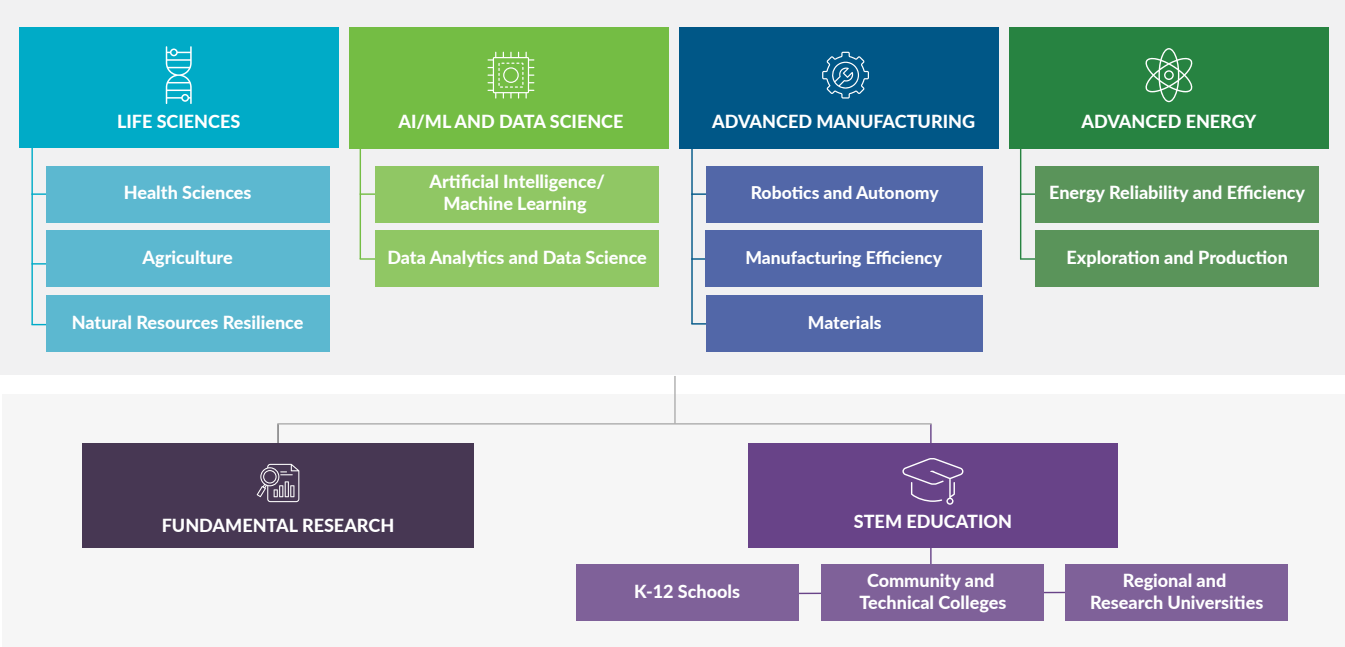
West Virginia will compete and succeed in the global economy by developing world-class research capabilities and a highly skilled STEM workforce.

Mission

Vision 2030 will advance the diversification and growth of the West Virginia economy based on research, innovation, and STEM talent.

High-Priority Research Areas

Vision 2030 identifies high-priority research areas that build on West Virginia's existing academic and industrial research strengths and leverage state and federal priorities. Growth in research and the number of faculty and students working in these areas will support the long-term competitiveness of key industries in West Virginia, including health care, IT/cyber/software, advanced manufacturing, and advanced energy. Consequently, plan stakeholders identified a set of high-priority research areas, that includes the Health Sciences (field of science focused on the diagnosis, treatment, and prevention of disease), Artificial Intelligence/Machine Learning, Robotics and Autonomy, and Energy Reliability and Production, among others.



Strategy

	GOALS	ACTIONS
R&D-Intensive Industry	Increase the number and size of R&D-intensive and technology-based companies in West Virginia	Work with West Virginia Division of Economic Development (WVDED) to attract and retain more mid-scale R&D-intensive companies and provide appropriate incentives
	Ensure West Virginia has the physical infrastructure and facilities appropriate to recruit and retain companies	Increase funding for the West Virginia Certified Sites and Development Readiness Program
STEM Talent	Increase the college-going rate by better preparing K–12 students in science, technology, engineering, and math (STEM) disciplines	Continue to provide STEM education support for students and teachers
	Increase research experiences, co-ops, and internships to retain STEM students and to increase job prospects	Develop a statewide system/network to facilitate opportunities for internships for college students
	Increase the number of STEM certificates and degrees completed	Expand dual enrollment and STEM pathways Leverage state and federal programs and scholarships to prepare and retain college students
Research Enterprise	Increase research expenditures, especially in the target platforms Increase the number of STEM graduate students to develop the research workforce pipeline	Increase R&D grants and contracts from all sources, including the West Virginia Research Challenge Fund which supports faculty in competing for larger external grants Address the high teaching loads of faculty and support faculty development Raise funds to help West Virginia compete for federal research dollars
Innovation and Entrepreneurship	Increase the number of R&D-intensive and technology-based startups in the state	Ensure funding for entrepreneurial support organizations and venture capital (VC) investment
	Increase the number of industry-university R&D collaborations	Increase small companies' access to university equipment and facilities
	Increase the commercialization of technology developed at academic institutions	Work to increase industry-university collaborations
	Increase the number of U.S. Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) awards and awardees	Provide incentives to graduate students and faculty to engage in technology commercialization Enhance the intellectual property process for academic institutions statewide Continue funding for West Virginia Entrepreneurship and Innovation Investment Fund (i.e., SBIR/STTR Phase I and II matching funds)

Governance and Implementation

Vision 2030 was developed with input from a variety of stakeholders representing government, industry, academia, and venture development organizations. The West Virginia Science and Research Council is the administrative body that approves and oversees the plan. The Council is chaired by Chancellor Tucker. To implement the plan, the West Virginia Science and Research Council's Executive Committee members who worked to develop the plan will continue to meet at least three times each year to support information sharing, communication, and coordination on implementation of Plan initiatives. Working groups will be formed as needed for focused work on initiatives or actions that support Plan implementation.

Impact: Performance on 2025 Goals

How has West Virginia performed on key science, technology, economic, and educational indicators over the past 5 years? RTI analyzed West Virginia's performance for the most recent 5-year period (either 2019–2024 or 2018–2023, depending on the latest available data). Over the past 5 years, RTI found that West Virginia's performance on Vision 2025 goals has been strong in some categories (e.g., growth in employment in R&D-intensive industry, research activity, and VC investment) and weaker in others (e.g., the college-going rate, some key categories of STEM degrees completion, and patenting).

R&D-Intensive Industry:

SIGNIFICANT PROGRESS IN ATTRACTING COMPANIES AND INVESTMENT

- ▲ R&D-intensive manufacturing companies, including Nucor, TIMET, Berkshire Hathaway Energy Renewables, Commercial Metals Company, Form Energy, One Energy, and others have made major investments in new West Virginia facilities.
- ▲ The National Oceanic and Atmospheric Administration (NOAA) announced a **$100 million** investment in a new modular high-performance computing facility.
- ▲ The West Virginia Legislature passed the West Virginia Site Certification and Development Program and appropriated **$5 million** to fund the pilot program.

Research Enterprise:

SUBSTANTIAL PROGRESS IN INCREASING BUSINESS AND ACADEMIC R&D EXPENDITURES

- ▲ Business R&D expenditures grew to **$444 million** in 2022 from **$238 million** in 2018.
- ▲ Academic R&D expenditures grew to **$304 million** in 2024 from **$213 million** in 2019, driven by growth in investments from federal sources.
- ▲ S&E doctoral degree completions grew to **153** total S&E degrees in 2023 from **122** in 2018.

STEM Talent:

PROGRESS LAGGED IN SOME HIGH-PRIORITY CERTIFICATE AND DEGREE PROGRAMS

- ▼ West Virginia's college-going rate trended downward from 2019 to 2024.
- ▼ S&E-related certificate and associate completions declined (S&E-related programs include engineering technicians, chemical operators, construction and the skilled trades, Commercial Driver's License trucking, and others).
- ▼ S&E bachelor's and master's degree completions also declined. S&E degrees include degrees in the life sciences, physical sciences, and engineering.
- ▲ Health sciences associate, bachelor's, and master's degree completions all increased. Health sciences programs span nursing, imaging, pharmacy, and medical school.

Innovation and Entrepreneurship:

PROGRESS WAS MIXED

- ▲ Industry-sponsored academic R&D expenditures increased to $6.5 million in 2024 (or 2.1% of total academic R&D), up from $6.3 million in 2019.
- ▼ The number of patents granted to West Virginia companies, academic institutions, and individuals declined **(-16 patents)** to **31 patents** in 2024.
- ● The number of Phase 1 SBIR/STTR awards grew by 2, but the number of Phase 2 awards declined by 2, based on 3-year rolling averages from 2018 to 2020 and 2022 to 2024.
- ▲ VC increased to nearly **$40 million** in investment via **54 deals** driven by activity in software, business-to-business (B2B) services, and business-to-customer (B2C) services.

About This Plan

Purpose

The West Virginia Higher Education Policy Commission selected RTI International and its partner, Keen Point Consulting, through a competitive bid to help develop its 2030 statewide S&T plan. This plan is an update to Vision 2025, which was West Virginia's previous statewide plan. Five-year updates of the Plan are used to identify STEM research platforms of strategic significance to the state and to align stakeholders around priorities that advance West Virginia's research enterprise and high-tech industry growth.

The statewide Science and Technology Plan is a requirement of the National Science Foundation (NSF) EPSCoR Research Infrastructure Improvement Track-1 grant, as well as the newer NSF EPSCoR Collaborations Optimizing Research (E-CORE) and EPSCoR Research Incubators in STEM Excellence (E-RISE) programs. The plan further serves to guide strategic decision-making by the West Virginia Division of Science & Research, the West Virginia Science & Research Council (the state EPSCoR jurisdictional committee), and other stakeholders working to advance the state's development over the next 5 years.

Approach

The Vision 2030 strategic plan framework, data collection (including interviews), and analysis performed in this study sought to answer four primary questions:

1. What are the major science, technology, engineering, and mathematics (STEM) research strengths of West Virginia's higher education institutions, and how do West Virginia's past-5-year growth rates in external research expenditures compare to other EPSCoR states?

2. What are the size and characteristics of West Virginia's research and development (R&D)-intensive industries, e.g., advanced manufacturing, IT and cybersecurity, the life sciences (health care, agriculture, forests), advanced energy?

3. What are West Virginia's statewide economic development and workforce development priorities for the next 5 years that are aligned to near-term and long-term growth opportunities?

4. What goals can West Virginia's STEM research enterprise pursue over the next 5 years to increase West Virginia's research and economic development competitiveness?

Report Organization

The first section of this report presents the Vision 2030 strategy, including its vision, mission, goals, actions, and supporting business case. It also presents the target S&T platforms and high-priority research areas, as well as recommendations for governance and implementation. The second section reviews key takeaways about where West Virginia stands on its performance on Vision 2025 goals in each of the four categories: (1) R&D-intensive industry, (2) STEM talent pipeline, (3) research competitiveness, and (4) innovation and entrepreneurship. The appendix includes the list of stakeholders interviewed for this plan, as well as time-series data and findings on nearly 30 metrics related to West Virginia competitiveness in the four Plan categories.

The 2030 Strategy

Vision

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Strategy

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	Ensure West Virginia has the physical infrastructure and facilities appropriate to recruit and retain companies	Increase funding for the West Virginia Certified Sites and Development Readiness Program
STEM Talent	Increase the college-going rate by better preparing K–12 students in science, technology, engineering, and math (STEM) disciplines	Continue to provide STEM education support for students and teachers
	Increase research experiences, co-ops, and internships to retain STEM students and to increase job prospects	Develop a statewide system/network to facilitate opportunities for internships for college students
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Innovation and Entrepreneurship	Increase the number of R&D-intensive and technology-based startups in the state	Ensure funding for entrepreneurial support organizations and venture capital (VC) investment
	Increase the number of industry-university R&D collaborations	Increase small companies' access to university equipment and facilities
	Increase the commercialization of technology developed at academic institutions	Work to increase industry-university collaborations
	Increase the number of U.S. Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) awards and awardees	Provide incentives to graduate students and faculty to engage in technology commercialization Enhance the intellectual property process for academic institutions statewide Continue funding for West Virginia Entrepreneurship and Innovation Investment Fund (i.e., SBIR/STTR Phase I and II matching funds)

Business Case for Action

R&D-Intensive Industry

To compete in a global economy, West Virginia companies must continually adopt technologies that improve quality, productivity, and performance. They must also introduce new or improved processes, technologies, and products to the marketplace—i.e., the definition of innovation.

Nationally, companies that report performing more R&D also report more innovation activity, although innovation requires more than just R&D.[1] However, companies in more R&D-intensive industries do tend to report higher sales growth, employment, and wage growth than companies in non–R&D-intensive sectors. Simply put, R&D supports innovation which can result in companies introducing new processes, technologies, and products that in turn help increase market share or create new business lines which drives sales growth and ultimately job growth.

At the state level, adding more R&D-intensive companies, industry, and employment over time will diversify West Virginia's economy and support long-term economic growth.

Today, mining and extraction, health care, and real estate are West Virginia's top three industries by gross domestic product (GDP).[2] Thirty years from now, West Virginia's economy will look much different and almost certainly much better if the top three industries are advanced manufacturing, professional and scientific services, and health care.

Figure 1 presents West Virginia's employment in high or medium-high R&D intensity manufacturing and services industries in 2024 and the total change and average annual growth in employment from 2019 to 2024.

Over the past 5 years, West Virginia has experienced higher growth rates in R&D-intensive manufacturing and services industries relative to all manufacturing and all services employment. Although West Virginia is starting from a smaller base of R&D-intensive companies and industry, the state can continue to increase this number by ensuring it has the right incentives, physical infrastructure, and workforce to provide a competitive business environment.

R&D-Intensive Industry		
GOALS		**ACTIONS**
Increase the number and size of R&D-intensive and technology-based companies in West Virginia	▶	Work with West Virginia Division of Economic Development (WVDED) to attract and retain more mid-scale R&D-intensive companies and provide appropriate incentives
Ensure West Virginia has the physical infrastructure and facilities appropriate to recruit and retain companies	▶	Increase funding for the West Virginia Certified Sites and Development Readiness Program

1 See National Science Board, National Science Foundation (2024). Science and Engineering Indicators 2024: The State of U.S. Science and Engineering. NSB-2024-3. Alexandria, VA. Available at **https://ncses.nsf.gov/pubs/nsb20243**, and Baumann, J. and A.S. Kritikos (2016). The link between R&D, innovation and productivity: Are micro firms different? Research Policy, 45(6): 1263-1274, **https://doi.org/10.1016/j.respol.2016.03.008**.

2 RTI analysis of U.S. Bureau of Labor Statistics, Gross Domestic Product by State with Industry Detail data.

FIGURE 1. SIZE AND GROWTH OF WEST VIRGINIA'S R&D-INTENSIVE INDUSTRIES, 2019, 2024, 5-YEAR CHANGE, 5-YEAR CAGR

NAICS	INDUSTRY TITLE	2019	2024	5-YEAR CHANGE	5-YEAR CAGR
NAICS	Industry Title	2019	2024	5-Year Change	5-Year CAGR
31-33	**All Manufacturing**	**46,979**	**46,068**	**-911**	**-0.4%**
	R&D-intensive manufacturing	15,265	16,716	1,451	1.8%
3362, 3363	Motor vehicles and parts	3,408	3,978	570	3.1%
3364	Aerospace product and parts	2,282	2,626	344	2.8%
3252	Resin, synthetic rubber, and synthetic fibers	2,512	2,270	-242	-2.0%
3331, 3339	Agriculture, construction, and mining machinery	1,553	1,890	337	4.0%
3251	Basic chemicals	2,226	1,741	-485	-4.8%
3255, 3259	Paint, coating, and adhesive	577	980	403	11.2%
3254	Pharmaceutical and medicine	ND	800	N/A	N/A
3391	Medical equipment and supplies	838	770	-68	-1.7%
334, 335, 3329, 33331	**All other R&D-intensive manufacturing**	**1,869**	**1,661**	**-208**	**-2.3%**
	All services	**447,900**	**457,018**	**9,118**	**0.4%**
	R&D-Intensive Services	6,941	9,905	2,964	7.4%
5415	Computer systems design	4,319	6,163	1,844	7.4%
5417	Scientific research and development	1,346	1,780	434	5.7%
518	Data processing and hosting	1,052	1,380	328	5.6%
5132	Software publishers	145	478	333	26.9%
519	**Other information services**	**79**	**104**	**25**	**5.7%**
	Total R&D-intensive industries	**22,206**	**26,621**	**4,415**	**3.7%**
10	**Total private sector employment**	**553,809**	**559,262**	**5,453**	**0.2%**

CAGR = Compound Annual Growth Rate
Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

STEM Talent

STEM workers are (1) scientists and engineers (S&E), (2) S&E-related workers (especially health care workers), and (3) skilled technical workers (e.g., engineering technicians, those working in the construction trades, chemical operators, maintenance and repair).

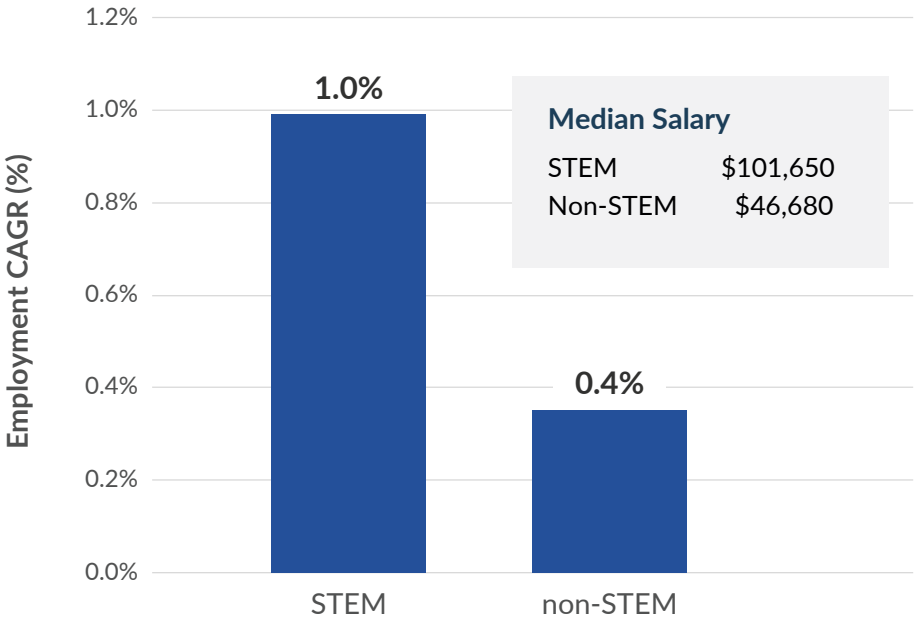
In a period of continuing adoption of robotics and software-enabled automation, employment of STEM workers nationally is projected to grow faster, with a 1% compound annual growth rate (CAGR) than non-S&E employment (0.4% CAGR) through 2033 (Figure 2).

Tracking national trends, analysis of employment by occupation data shows that West Virginia employment in S&E and S&E-related jobs grew faster (1.6% per year since 2019) than non-S&E jobs. The fastest growth was in computer-related jobs and health care jobs.

Like the employment data presented in Figure 1, employment in all production/manufacturing declined, as did employment in construction and extraction jobs over the past 5 years (Figure 3).

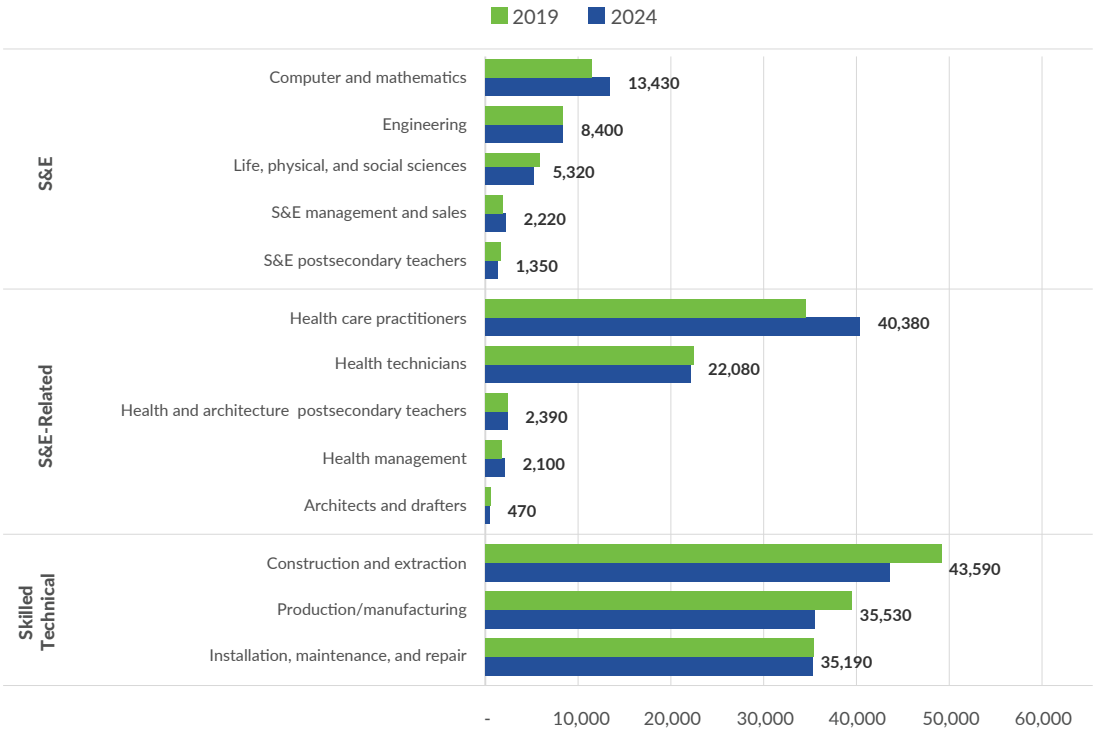
According to industry stakeholders RTI interviewed for this report, STEM jobs are in high demand, but there are not enough skilled workers to fill them. This will increasingly impact West Virginia's competitiveness and growth of R&D-intensive industries, such as advanced manufacturing, IT and cybersecurity, the life sciences (health care, agriculture, forests), and advanced energy. Strengthening the pipeline of STEM talent supports West Virginia's business competitiveness and also creates pathways to high-quality, well-paying jobs for West Virginians across a range of educational backgrounds. To continue the growth in S&E and S&E-related fields, Vision 2030 recommends the following goals and actions.

FIGURE 2. PROJECTED GROWTH IN U.S. STEM VS NON STEM JOBS, 2023–2033



Source: U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

FIGURE 3. WEST VIRGINIA WORKERS EMPLOYED IN STEM OCCUPATIONS, 2019 AND 2024



Source: U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

STEM Talent

GOALS	ACTIONS
Increase the college-going rate by better preparing K–12 students in science, technology, engineering, and math (STEM) disciplines	Continue to provide STEM education support for students and teachers
Increase research experiences, co-ops, and internships to retain STEM students and to increase job prospects	Develop a statewide system/network to facilitate opportunities for internships for college students
Increase the number of STEM certificates and degrees completed	Expand dual enrollment and STEM pathways Leverage state and federal programs and scholarships to prepare and retain college students

Note: [1] West Virginia Learn and Earn is a state-funded grant program that supports paid internship opportunities for students attending a West Virginia Community and Technical College. The state provides funding to pay half a student intern's wages while they are in school, and the employer pays the other half. [2] West Virginia's Career and Technical Education (CTE) pathways program provides hands-on, technical training to high school students to prepare them for post-secondary education in high-demand careers. West Virginia could pilot an Engineering CTE pathway leading to an associate or applied science degree in engineering technology.

Research Enterprise

The health and vitality of West Virginia's research enterprise impacts many of West Virginia's other science, technology, and economic goals: STEM education and talent development, industry collaboration and innovation activity, and scientific discovery and translation. First, academic R&D plays a critical role in the training of future scientists and engineers by providing hands-on experiences that require teamwork and problem-solving skills. Attrition is a problem, and research experiences can help retain students in their STEM degree programs. External research funding is also an important source of financial support for graduate students, as well as undergraduates engaged in research over the summer or during the semester, helping to offset tuition and other costs.

Second, academic research helps faculty stay current in their field and drives scientific discovery and technology development. Research can lead to novel discoveries and the creation of intellectual property—which, in turn, can be spun out into newly formed start-up companies or licensed by existing companies. Research is also one way that companies engage with academic institutions to access faculty subject matter experts or to utilize specialized equipment needed to support projects to resolve technical problems with a product or manufacturing process or develop and commercialize new products, technologies, and processes.

West Virginia experienced very strong growth in academic R&D expenditures over the past 5 years, from $211.7 million in 2019 to $304.3 million in 2024 (Figure 4). This growth was driven primarily by increases in federal research dollars awarded. West Virginia was also able to attract and retain graduate students as S&E doctoral degree recipients increased by 4.6% per year, totaling 153 in 2023 (latest available data). Vision 2030 maintains this focus on expanding research activity and the pipeline of S&E graduate students.

Going forward, with federal research dollars likely to decline and with competition for remaining dollars likely to increase, state support for STEM research and education will have an outsized impact on West Virginia's ability to compete for external funds. Importantly, at least some if not many other states will increase their state support for STEM research and education in light of the changes in federal support, making it even more important for West Virginia to do the same to stay competitive. Vision 2030 calls for examining best practice financing models in other states and then raising funds to help West Virginia compete for industry and federal research dollars.

FIGURE 4. WEST VIRGINIA ACADEMIC R&D EXPENDITURES ($M) BY SOURCE, 2014, 2019, 2024, AND 10- AND 5-YEAR CAGR

SOURCE	Year			CAGR %	
	2014	2019	2024	10-YEAR	5-YEAR
U.S. federal government	$90.4	$90.5	$155.0	5.5%	9.9%
Institutional funds	$65.2	$76.2	$97.0	4.1%	4.9%
State and local government	$13.8	$11.9	$13.4	-0.3%	2.5%
All other sources	$8.4	$15.8	$19.6	12.1%	10.8%
Industry-sponsored	$12.8	$6.3	$6.5	-6.5%	-13.0%
Nonprofit organizations	$5.1	$6.2	$6.0	1.6%	-0.8%
Total	**$195.7**	**$211.7**	**$304.3**	**4.5%**	**7.4%**

Source: National Center for Science and Engineering Statistics, Higher Education R&D Survey

Research Enterprise

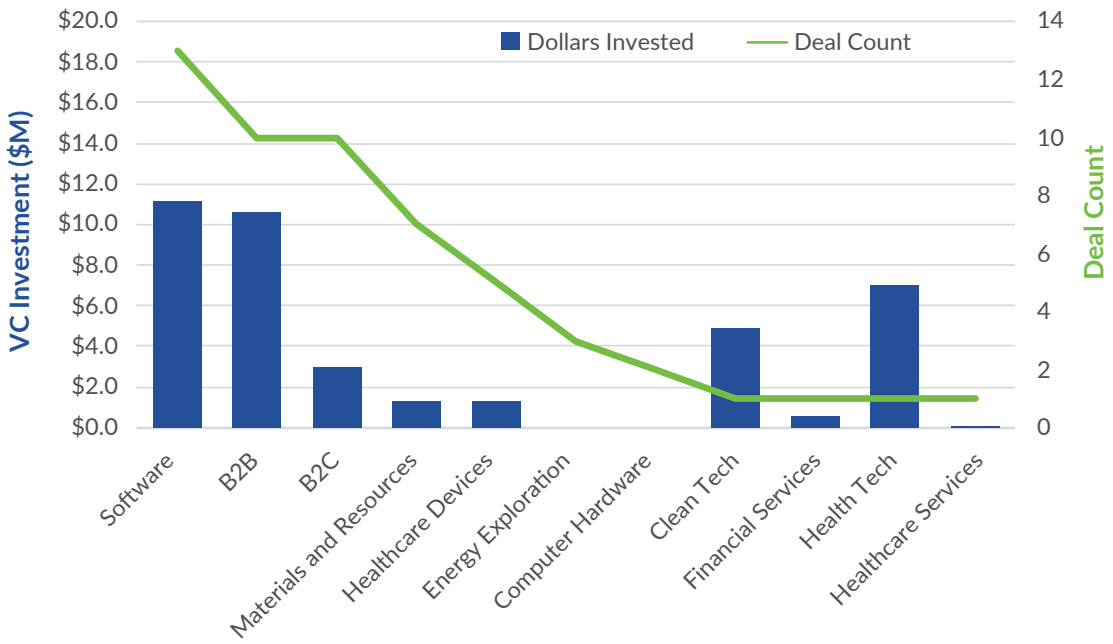
GOALS	ACTIONS
Increase research expenditures, especially in the target platforms Increase the number of STEM graduate students to develop the research workforce pipeline	Increase R&D grants and contracts from all sources, including the West Virginia Research Challenge Fund which supports faculty in competing for larger external grants Address the high teaching loads of faculty and support faculty development Raise funds to help West Virginia compete for federal research dollars

Innovation and Entrepreneurship

As noted in the R&D-Intensive Industry section, there is a strong positive correlation between companies that perform R&D and higher levels of innovation in terms of introducing new products, technologies, and process improvements. To diversify its economy, West Virginia needs more innovative, higher-growth companies, and the two ways to do this are by starting new entrepreneurial ventures and by recruiting existing companies looking to expand. Entrepreneurship has long been an economic development focus in West Virginia. Nationally, the Federal Reserve Board's Survey of Consumer Finance finds that 20% of families own a privately held business, and that half of the families in the top 10% by income in 2022 reported owning a business.[3] Business ownership is positively correlated with income.[4]

There is no federal data source for tracking the number of R&D-intensive or technology-based startups in each state. Pitchbook, a private venture capital and private equity data analytics company, tracks investments in VC-backed startups, but not all angel and deals are reported. Consequently, policymakers look to a variety of indirect indicators. One indicator of intellectual property creation, which is positively correlated with innovation activity, is patents. The number of patents granted to West Virginia companies, academic institutions, and individuals declined (-16 patents) to 31 patents between 2019 and 2024. Another is SBIR/STTR awards, which is commonly referred to as the federal government's seed capital fund, because it provides grants for technology commercialization and commercial validation. West Virginia's total number of Phase 1 SBIR/STTR awards grew by 2, but the number of Phase 2 awards declined by 2, based on 3-year rolling averages from 2018 to 2020 and 2022 to 2024. A third indicator is venture capital. Venture capital is a type of high-risk financing for early-stage companies trying to bring new products to market. These companies often do not have revenue or other

FIGURE 5. WEST VIRGINIA'S VC DEALS AND VC INVESTMENT ($M) BY INDUSTRY, 2020–2024



Source: Pitchbook, Venture Capital and Private Equity Database

3 Aladangady, A., J. Bricker, A.C. Chang, S. Goodman, J. Krimmel, Kevin B. Moore, Sarah Reber, Alice Henriques Volz, and Richard A. Windle (2023). Changes in U.S. Family Finances from 2019 to 2022: Evidence from the Survey of Consumer Finances. Washington: Board of Governors of the Federal Reserve System, October, **https://doi.org/10.17016/8799**.

4 However, many businesses fail, and 15% of families in the bottom 50% of income report owning a business. Entrepreneurship is a high risk, high reward activity.

collateral, and venture capital firms take equity positions in these companies in exchange for investment. West Virginia increased its five-year VC investment activity to 54 deals and nearly $40 million in investment from 2020 to 2024. This is up from five-year VC investment of $35.4 million in 21 deals from 2015 to 2019. Over the past five years, software, business-to-business (B2B) services, and business-to-customer (B2C) services were the top three sectors based on deal count (orange line). Health tech was third as measured by VC investment (blue column) (Figure 5).

Interviews with stakeholders representing private and state-supported VC investors and entrepreneurial support organizations indicate that West Virginia's entrepreneurial ecosystem and investor community are collaborative and engaged. West Virginia received $72 million in U.S. Treasury Department State Small Business Credit Initiative (SSBCI) funds in 2022 that it is administered through the West Virginia Jobs Investment Trust and West Virginia Capital Access Program. However, there are a limited number of experienced startup founders, and academic inventors often lack the industry experience and business development experience needed to launch successful new ventures. In addition, academic inventors often do not have institutional incentives for trying to launch a new business (beyond the possibility of making money and seeing their ideas commercialized).

Funding for entrepreneurial support organizations is much needed but remains a challenge.

Increasing R&D collaboration with industry is one way to expose faculty and students to the type of technical challenges that companies are working on. These working relationships can help develop the network of industry subject matter experts who can advise faculty on tech transfer opportunities that arise. Industry-sponsored R&D expenditures is one indicator of this collaboration. Industry-sponsored research at West Virginia academic institutions increased slightly to $6.5 million from $6.3 million in 2019. Industry-sponsored research represented 2.1% of all academic R&D expenditures in 2024. This figure was just below the Established Program to Stimulate Competitive Research (EPSCoR) institution median of $6.9 million.

Continued work is needed to strengthen the pipeline of new ventures. The goals and actions listed below provide a framework to make that progress.

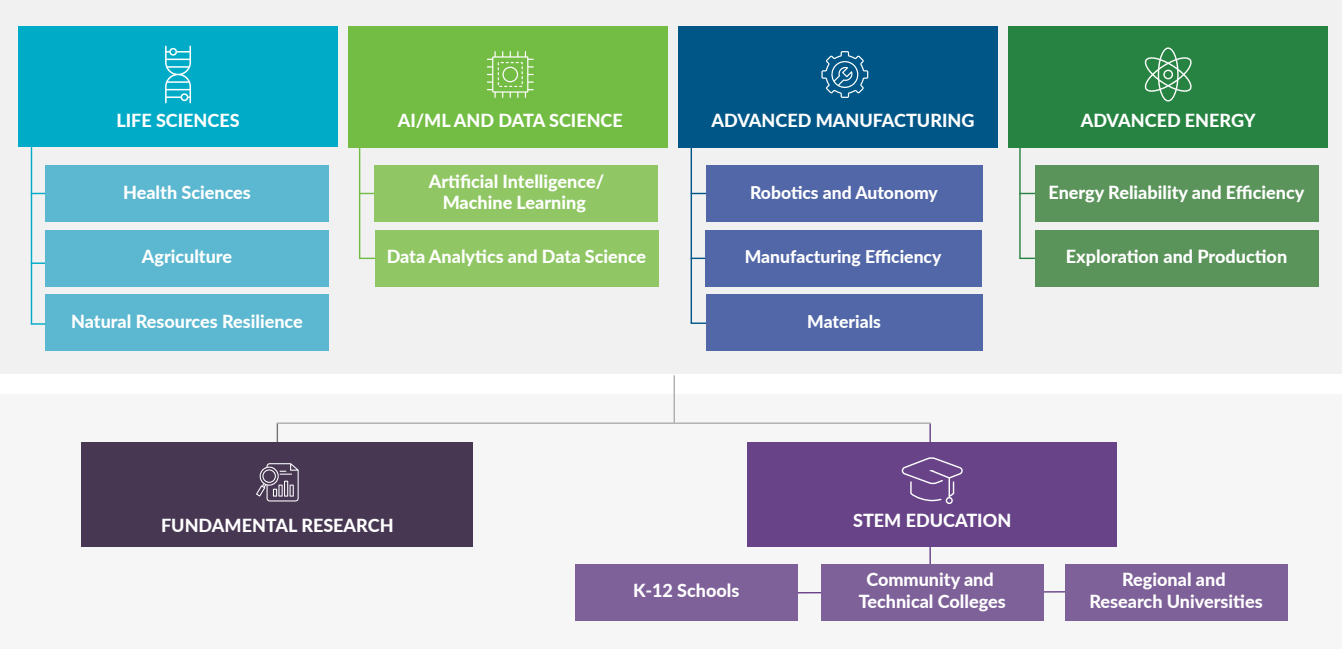
This section presented the rationale for why West Virginia must redouble its efforts and continue to move forward in advancing the role of STEM education, research, and innovation in its economy. Vision 2030 identifies goals and actions that government, industry, and academic stakeholders will pursue over the next five years in support of the plan vision and mission.

Innovation and Entrepreneurship

GOALS	ACTIONS
Increase the number of R&D-intensive and technology-based startups in the state	Ensure funding for entrepreneurial support organizations and venture capital (VC) investment
Increase the number of industry-university R&D collaborations	Increase small companies' access to university equipment and facilities
Increase the commercialization of technology developed at academic institutions	Work to increase industry-university collaborations
Increase the number of U.S. Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) awards and awardees	Provide incentives to graduate students and faculty to engage in technology commercialization Enhance the intellectual property process for academic institutions statewide Continue funding for West Virginia Entrepreneurship and Innovation Investment Fund (i.e., SBIR/STTR Phase I and II matching funds)

High-Priority Research Areas

Vision 2030 identifies high-priority research areas that build on West Virginia's existing academic and industrial research strengths and leverage state and federal priorities. Growth in research and the number of faculty and students working in these areas will support the long-term competitiveness of key industries in West Virginia, including health care, IT/cyber/software, advanced manufacturing, and advanced energy. Consequently, plan stakeholders identified a set of high-priority research areas, that includes the Health Sciences (field of science focused on the diagnosis, treatment, and prevention of disease), Artificial Intelligence/Machine Learning, Robotics and Autonomy, and Energy Reliability and Production, among others.



Governance and Implementation

Vision 2030 was developed with input from a variety of stakeholders representing government, industry, academia, and venture development organizations. The West Virginia Science and Research Council is the administrative body that approves and oversees the plan. The Council is chaired by Chancellor Tucker. To implement the plan, the West Virginia Science and Research Council's Executive Committee members who worked to develop this plan will continue to meet at last three times each year to support information sharing, communication, and coordination on implementation of Plan initiatives. Working groups will be formed, as needed, for focused work on initiatives or actions that support Plan implementation.

Performance on 2025 Goals

Five years ago, West Virginia academic, industry, and government stakeholders set the following goals for Vision 2025:

- Increase the number of students pursuing and completing STEM degrees at all levels.
- Expand the size of West Virginia's STEM workforce.
- Recruit new companies and support the growth of existing advanced manufacturing and R&D-intensive services companies.
- Attract more public and private research funding in target areas.
- Support growth in research commercialization, innovation, and startup activity across the state.

This section presents data related to how West Virginia has performed on its goals in each of the four categories over the past 5 years. The state's performance was strong in some categories (e.g., growth in employment in R&D-intensive industry, research activity, and VC investment) and weaker in others (e.g., the college-going rate, some key categories of STEM degrees completion, and patenting).

R&D-Intensive Industry

Over the past 5 years, West Virginia has recruited major R&D-intensive companies and investment. These companies include Nucor, TIMET, Berkshire Hathaway Energy Renewables, CMC, Form Energy, and One Energy. In addition, NOAA invested $100 million dollars in a new supercomputing facility located inside the West Virginia High Technology Foundation's I-79 High Technology Park.

Supporting these recruitments were significant state and federal investment in physical infrastructure in industrial sites. In 2022, the West Virginia Legislature passed legislation to establish the West Virginia Site Certification and Development Readiness Program, approving $5 million to implement the pilot program. The West Virginia Legislature also appropriated money to invest in new lab space for multiple state agencies at the West Virginia Regional Technology Park in South Charleston, WV.

From 2019 to 2024, R&D-intensive manufacturing employment grew 1.8% per year, compared to all manufacturing employment, which declined slightly by 0.4% per year. R&D-intensive services employment grew 7.4% per year, compared to all services employment which grew by 0.4% per year (see Appendix Figure 1 for list of R&D-intensive industries and Appendix Figure 3 for West Virginia employment in each industry).

FIGURE 6. EMPLOYMENT IN R&D-INTENSIVE MANUFACTURING AND SERVICES COMPARED TO ALL MANUFACTURING AND SERVICES, CURENT AND 2019–2024 CHANGE

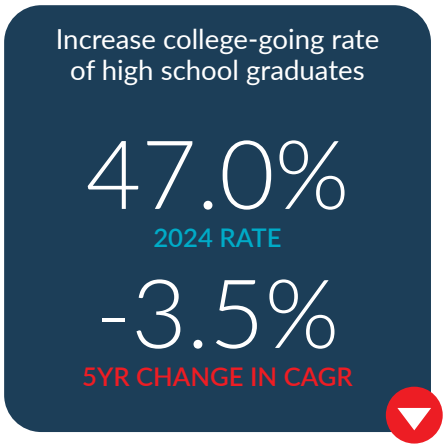
Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

STEM Talent Pipeline: Education

West Virginia R&D-intensive companies employ and generate demand for STEM talent—both those with years of industry experience and individuals new to the field. At the beginning of the STEM talent pipeline are students and workers pursuing STEM education beyond high school. They can be broken down into two categories: (1) S&E degrees and (2) S&E-related degrees. S&E-related degrees include the very large subcategory of health sciences.

Over the past 5 years, West Virginia lost ground on some indicators and made gains in others. The state's college-going rate is 3.5 percentage points lower than in 2019.

FIGURE 7. COLLEGE-GOING RATE, CURRENT AND 2019–2024 CHANGE



Source: West Virginia Higher Education Policy Commission

Certificates

Despite strong demand by employers for workers who have completed training programs and the lower cost and time required to complete these programs compared to degree programs, West Virginia S&E-related and health sciences certificate completions decreased from 2018 to 2023. The top five S&E-related programs in 2023 were engineering technician, commercial driver's license truck driving, electrical and power transmission, precision metal working, and vehicle maintenance and repair (see Appendix Figure 8). By comparison, certificate completions in S&E increased (+24) from a small base (95 completions). S&E certificate programs were limited to computer and information services and veterinary technician.

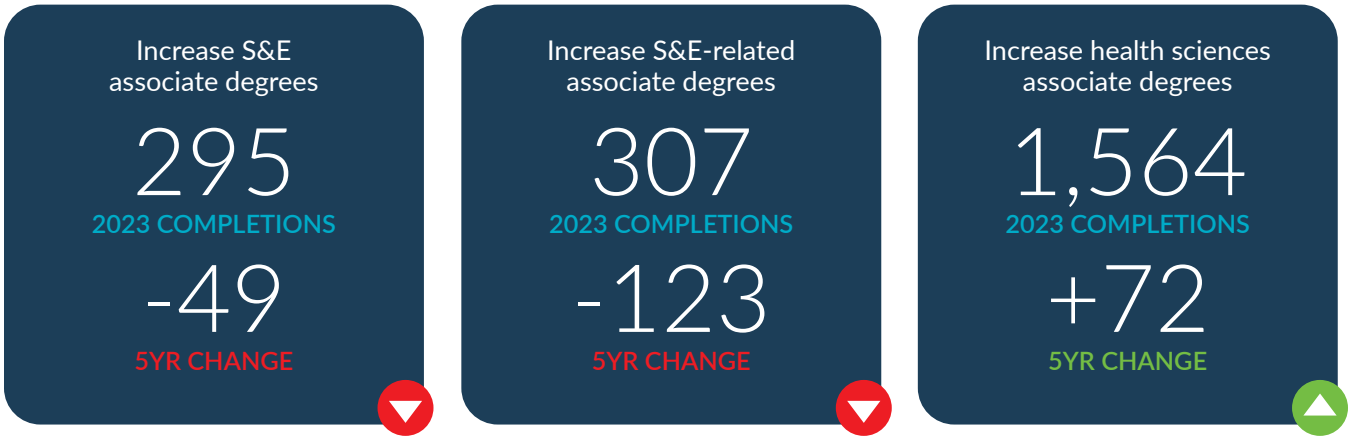
FIGURE 8. CERTIFICATES, 2023 COMPLETIONS AND 2018–2023 CHANGE

Source: National Center for Education Statistics, Integrated Postsecondary Education Data System

Associate Degrees

Fewer students completed S&E-related associate degrees compared to certificates (307 vs. 914 awarded, respectively) in 2023 compared to 2018. Moreover, the number of S&E-related associate degrees awarded fell from 430 to 307. One reason based in anecdotal evidence is that strong demand from employers has translated into students being hired as full-time employees before completing their associate degrees or certificate programs. The top five S&E-related associate degrees in 2023 were vehicle maintenance and repair, electrical technician, precision metal working, electrical and power transmission, and construction engineering (see Appendix Figure 10). Students tend to prefer associate degrees in S&E and health sciences over certificates or apprenticeship programs unless they are fairly certain that a certificate or apprenticeship will lead directly to a job with an already identified company. The number of health sciences associate degrees increased (+72), while S&E associate degrees awarded declined (-49) from 2018 to 2023.

FIGURE 9. ASSOCIATE DEGREES, 2023 COMPLETIONS AND 2018–2023 CHANGE

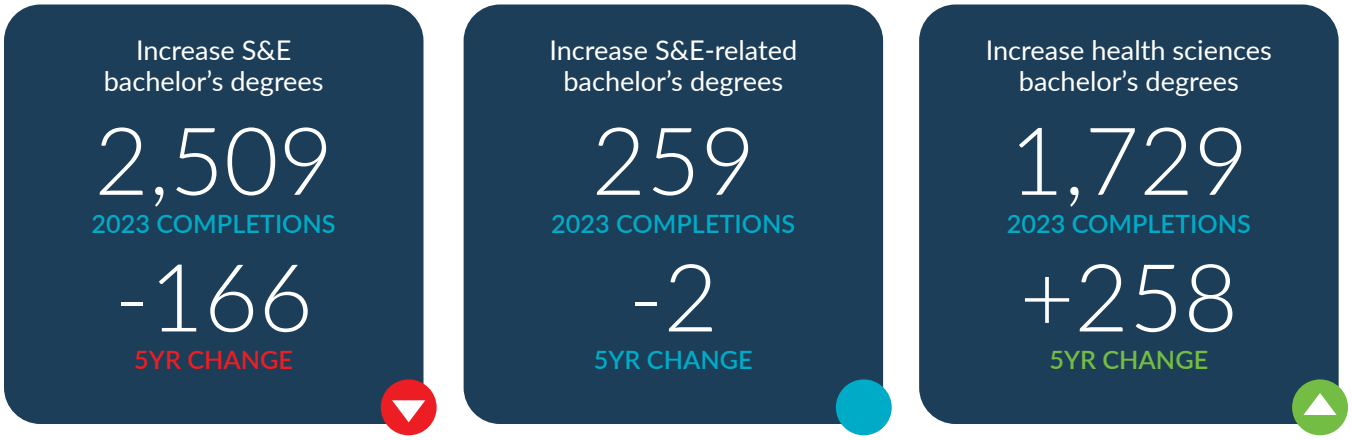


Source: National Center for Education Statistics, Integrated Postsecondary Education Data System

Bachelor's Degrees

A bachelor's degree was the most-preferred degree type for students pursuing S&E (2,509 completions) and health sciences degrees (1,729 completions). This was the least-preferred degree type for students pursuing S&E-related degrees (259). Within S&E fields, science disciplines accounted for most completions (1,806), led by biological and biomedical sciences and psychology. Engineering fields awarded 703 degrees, with mechanical and civil engineering as the top programs (see Appendix Figure 12). S&E bachelor's degrees declined by 166 (-1.3% CAGR) from 2018 to 2023. S&E-related bachelor's degrees were relatively flat (-2) over the same period, and health sciences degrees awarded increased by 258.

FIGURE 10. BACHELOR'S DEGREES, 2023 COMPLETIONS AND 2018–2023 CHANGE

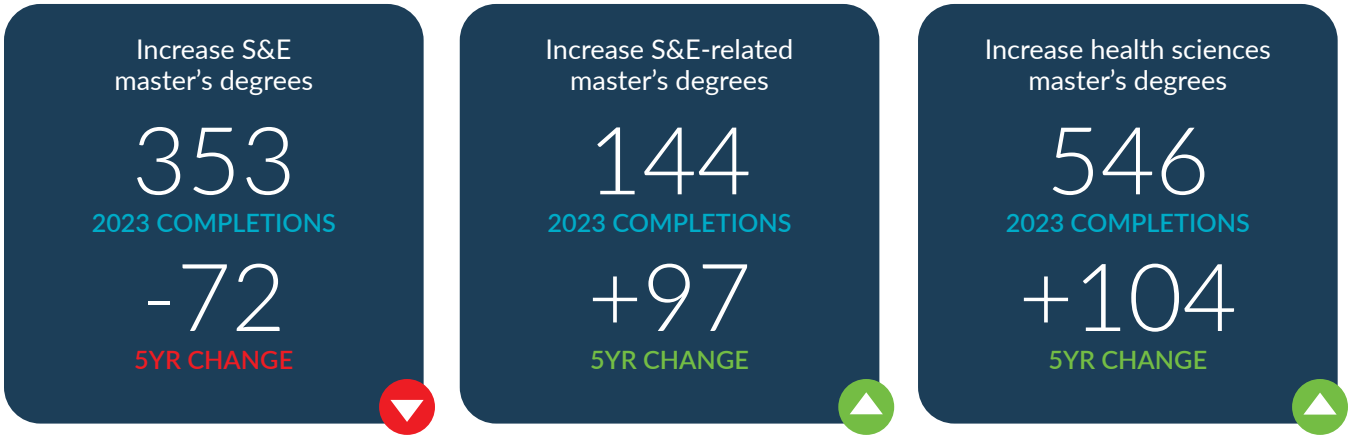


Source: National Center for Education Statistics, Integrated Postsecondary Education Data System

Master's Degrees

S&E master's degrees declined from 2018 to 2023, primarily driven by decreases in engineering fields, while science fields remained more stable (see Appendix Figure 13). By contrast, the number of S&E-related master's degrees completed grew (+97), led by programs in security science and technology and quality control and safety technologies (see Appendix Figure 13). Health sciences master's degrees also grew during this period, to 546 in 2023. Most master's degree completions were in health sciences fields.

FIGURE 11. MASTER'S DEGREES, 2023 COMPLETIONS AND 2018–2023 CHANGE

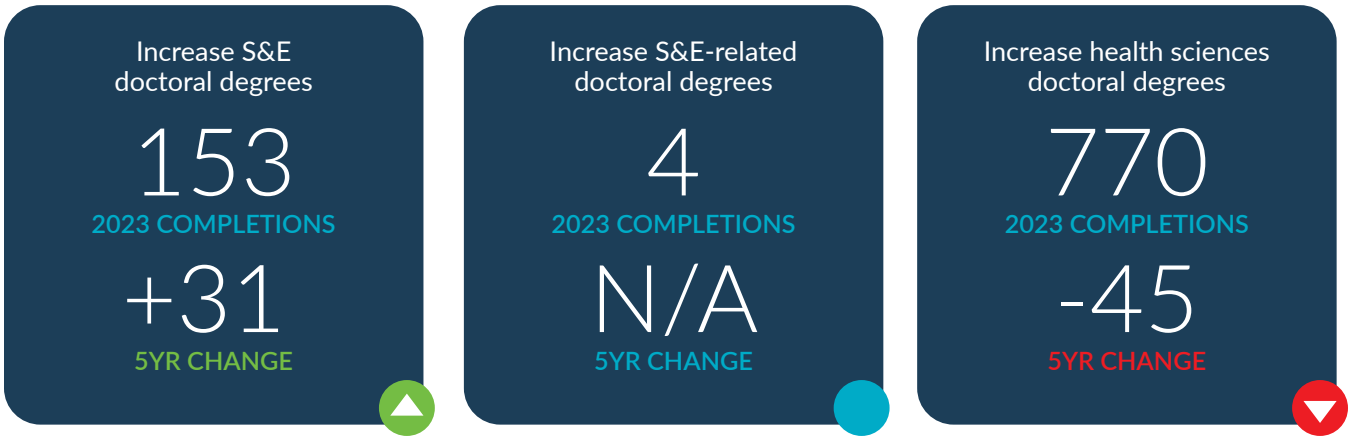


Source: National Center for Education Statistics, Integrated Postsecondary Education Data System

Doctoral Degrees

West Virginia S&E doctoral degrees awarded grew strongly from 2018 to 2023 (by 31 completions) to 153 total PhDs conferred in 2023. This growth was driven by science fields (+27), particularly biological and biomedical sciences, psychology, and physical science programs. Doctoral degrees awarded in engineering fields also increased, but at a much lower rate (+4) over the same period (see Appendix Figure 14). Doctoral completions in S&E-related fields was minimal, with four degrees awarded in homeland security and fire protection (see Appendix Figure 14). Health sciences doctoral degrees declined by 45 degrees.

FIGURE 12. DOCTORAL DEGREES, 2023 COMPLETIONS AND 2018–2023 CHANGE



Source: National Center for Education Statistics, Integrated Postsecondary Education Data Syste

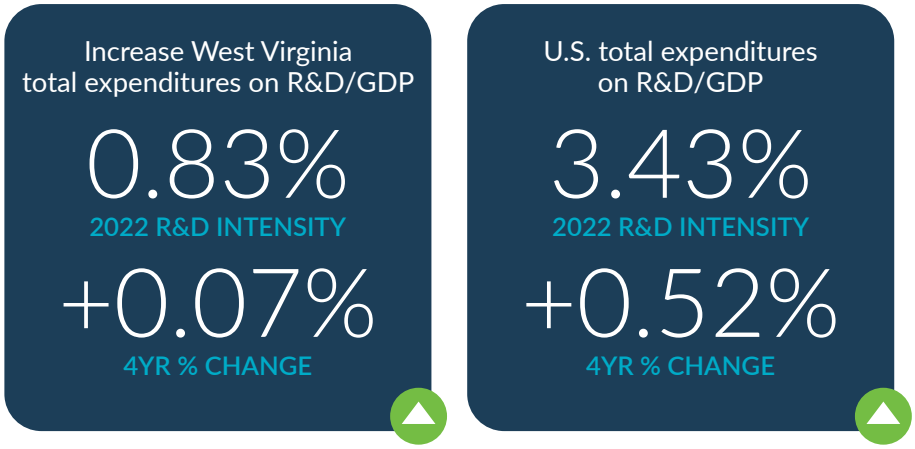
Research Competitiveness

R&D Intensity of the West Virginia Economy

R&D intensity—measured as total R&D expenditures relative to GDP—is a key indicator for how R&D-intensive and technology-driven an economy is. Advanced economies typically have an R&D intensity around 3%, while developing economies are usually below 1%. To stay competitive, R&D-intensive economies must continue to transition toward higher value–added activities and industries that are more R&D-intensive.

In 2022,[5] West Virginia's R&D intensity was 0.83% compared to the national R&D intensity of 3.43%. Driven by growth in academic and business R&D expenditures, West Virginia's R&D intensity grew from 0.76% in 2018 to 0.83% in 2022.

FIGURE 13. WEST VIRGINIA R&D INTENSITY, 2022 R&D INTENSITY AND CHANGE



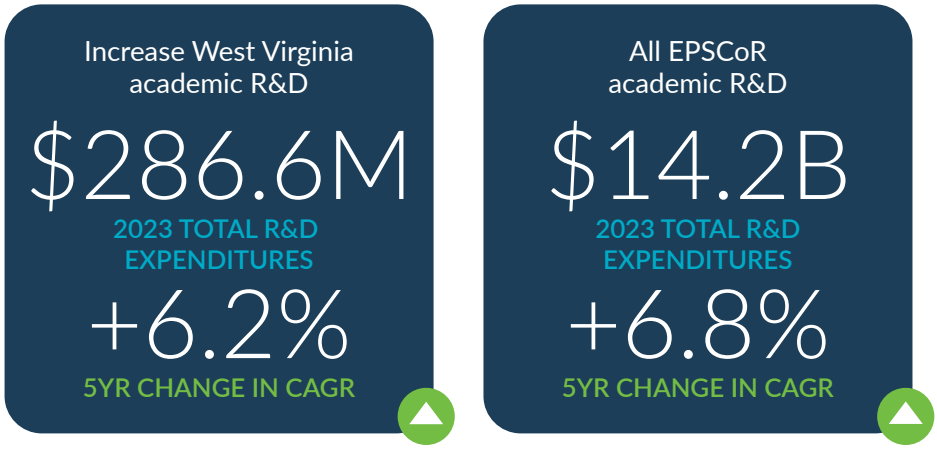
Note: The latest available data for gross expenditures on R&D at the state level are from 2022.
Source: National Center for Science and Engineering Statistics, National Patterns of R&D Resources

5 The latest available data for Gross Expenditures on Research and Development are from 2022.

Academic R&D

Academic research contributes to new scientific discoveries and technologies, as well as education and training of the future STEM workforce. Both outcomes fuel the number of R&D-intensive companies and economy of the region and help push it toward a higher R&D intensity.[6] Funding for academic R&D comes from a range of sources, including federal agencies, businesses, state and local government, institutional funds, and nonprofit organizations. West Virginia's academic R&D expenditures grew from $211.7 million in 2018 to $286.6 million in 2023, an average annual growth rate of 6.2%. Growth has been largely driven by federal research funding, which accounted for nearly 50% of academic R&D expenditures in 2023 (see Appendix Figure 21). The most recent 5-year growth outpaced West Virginia's 10-year average growth of 3.8%. The state's recent growth is approaching the EPSCoR average of 6.8%.

FIGURE 14. WEST VIRGINIA ACADEMIC R&D, 2023 R&D EXPENDITURES AND 2018–2023 CHANGE



Source: National Center for Science and Engineering Statistics, Higher Education Research and Development Survey

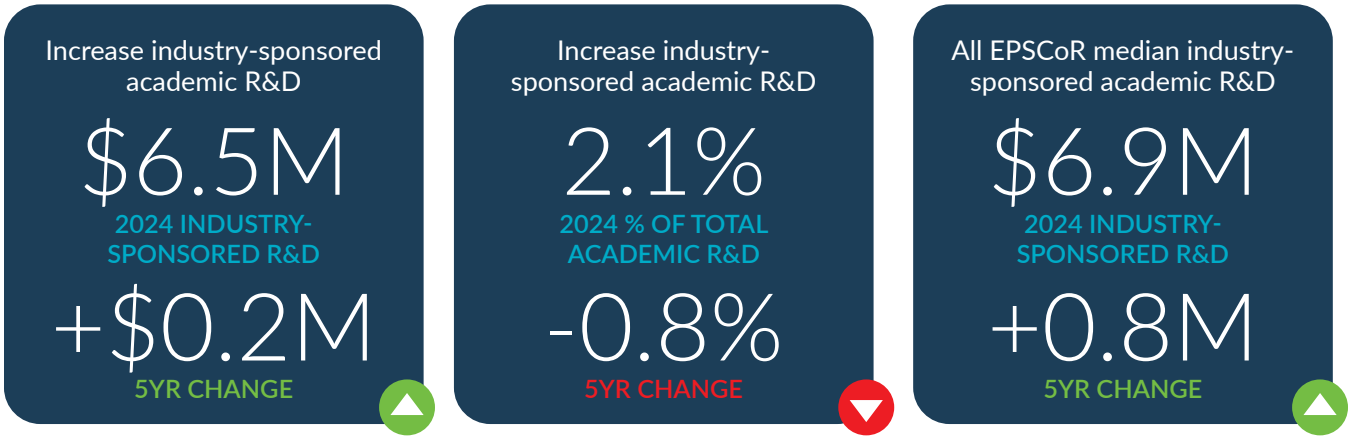
6 National Center for Science and Engineering. 2023. Academic Research and Development. *Science and Engineering Indicators*. **https://ncses.nsf.gov/pubs/nsb202326/executive-summary**

Innovation and Entrepreneurship

Industry-Sponsored Academic R&D

West Virginia academic R&D projects and expenditures funded by companies grew by 0.9% annually— from $6.3 million in 2019 to $6.5 million in 2024 (see Figure 15). However, industry-sponsored R&D expenditures are down compared to 10 years ago. In 2014, industry-sponsored R&D expenditures were $12.8 million compared to $6.5 million in 2024. (see Appendix Figure 21). The EPSCOR institution median for industry-sponsored academic R&D was $6.9 million—$0.4 million higher than the total in West Virginia.

FIGURE 15. INDUSTRY-SPONSORED ACADEMIC R&D, CURRENT, 2019–2024 CHANGE

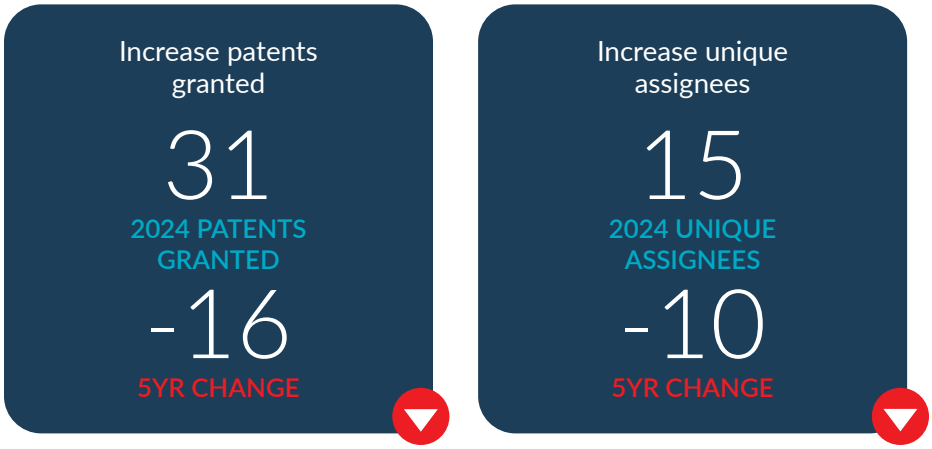


Note: West Virginia industry-sponsored academic R&D expenditures for 2024 are preliminary, and the EPSCoR median for all institutions is based on 2023 data.
Source: National Center for Science and Engineering Statistics, Higher Education Research and Development Survey

Patents

West Virginia innovation activity measured by patents awarded by the U.S. Patent and Trademark Office declined from 47 patents in 2019 to 31 in 2024. The number of unique assignees (i.e., companies, universities, and individual inventors receiving patents) declined from 25 to 15 over the same period (see Figure 16 and Appendix Figures 25 and 26).

FIGURE 16. PATENTS GRANTED TO WEST VIRGINIA ASSIGNEES, CURRENT AND 2019–2024 CHANGE

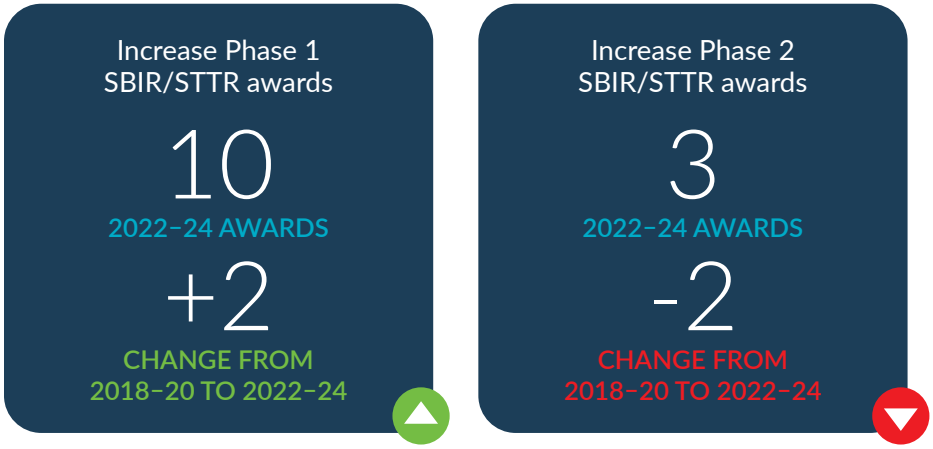


Source: U.S. Patent and Trademark Office, PatentsView

SBIR/STTR Awards

SBIR/STTR grants are commonly referred to as the U.S. government's seed capital fund. West Virginia's SBIR/STTR Phase 1 awards averaged $1.4 million and increased by two awards from 2018–2020 to 2022–2024 (see Appendix Figure 27). The larger SBIR/STTR Phase 2 awards averaged $4.2 million but declined by two awards over the same period (see Figure 17).

FIGURE 17. WEST VIRGINIA SBIR/STTR AWARDS, 3-YEAR ROLLING AVERAGES



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

Venture Capital Investment

The number of VC deals and total VC investment in West Virginia increased between the two 5-year periods. From 2020 to 2024, VC investment totaled $39.8 million in 54 deals. This represents an increase from $35.4 million in 21 deals between 2015 and 2019. This growth was driven by investments in software ($11.2 million), business-to-business ($10.6 million), and health technology ($7 million) sectors. From 2020 to 2024, there were investments across a wider variety of sectors (eight sectors) compared to the previous period (six sectors). In 2015–2019, energy exploration ($18.2 million) and business-to-business ($10.6 million) attracted the most capital, while material resources (which had the third-highest level of investment) only received $3.5 million (see Appendix Figures 28 and 29).

FIGURE 18. WEST VIRGINIA VC DEAL AND INVESTMENT, 2020–2024 AND CHANGE SINCE 2015–2019

Source: Pitchbook, Venture Capital and Private Equity Database

Appendix

List of Contributing Stakeholders

Higher Education

Bridge Valley Community and Technical College
Casey Sacks, PhD, President

Marshall University
John Maher, PhD, Vice President for Research
Suzanne Strait, PhD, Associate Vice President for Research Development

Shepherd University
Jason Best, PhD, Assistant Vice President for Strategic Planning and Institutional Effectiveness
Brooke Comer, PhD, Assistant Professor of Environmental Studies
Sher Hendrickson, PhD, Professor of Biology
Conor Sipe, PhD, Associate Professor of Biology

West Virginia State University
Ali Al-Sinayyid, PhD, Assistant Professor of Computer Science, Director of the Cybersecurity Innovation Center
Micheal Fultz, PhD, Associate Provost and Associate Vice President for Academic Affairs
Barbara E. Liedl, PhD, Associate Professor of Plant Breeding and Genetics
Sanju Sanjaya, PhD, Assistant Professor of Bioenergy and Environmental Biotechnology, Director of the Energy and Environmental Science Institute
Naveed Zaman, PhD, Dean, College of Natural Sciences and Mathematics

West Virginia University
Stanley Hileman, PhD, Professor and Program Coordinator, West Virginia IDeA Network of Biomedical Research Excellence Steering Committee
Jason Hubbart, PhD, Professor, Associate Director of the West Virginia Agricultural and Forestry Experiment Station, and Associate Dean of Research for the Division of Land-Grant Engagement
Fred King, PhD, Vice President for Research
Ming Lei, PhD, Senior Associate Vice President, Office of Research and Graduate Education, and Vice Dean of Research, School of Medicine
Sheena Murphy, PhD, Associate Vice President for Research
Melanie Page, PhD, Associate Vice President for Research and Scholarly Creativity
Rita Rio, PhD, Professor of Biology, Associate Dean for Research and Graduate Studies
Gay Stewart, PhD, Eberly Professor of STEM Education, Director, Center for Excellence in STEM Education

Industry

Matt Ballard, MPA, Director, West Virginia Regional Technology Park
Bill Bisset, EdD, President, West Virginia Manufacturers Association
Bryan Brown, BS, Executive Director, Bioscience Association of West Virginia
Candace Childers, MBA, PMP, General Manager, Alcon
Jack Dever, PhD, CTO and EVP, AVN Corporation
Kevin DiGregorio, PhD, Executive Director, Chemical Alliance Zone
James Estep, MS, President, High Technology Foundation
George Gannon, MA, Corporate Communications Analyst, Toyota
Greg Henthorn, MBA, Chief Business Officer, AmeriCarbon
John Hebert, BS, Site Manufacturing Director, Dow
Tyrone Lam, BA, Chief Operating Officer, GATC Health
Kevin Legg, BS, Director of Business Development, Worley (formerly Jacobs)
Tracy Miller, MA, President, Mid-Atlantic Aerospace Complex
Rebecca McPhail, BA, Vice President, American Chemistry Council
Markee Schindler, BA, Talent and Community Relations Manager, Nucor Steel

State Government

Adam Carter, EdD, Director of Career and Technical Education, West Virginia Department of Education
Matt Herridge, PhD, Secretary of Commerce
Erika Klose, EdD, Director of the Office of PK–12 Academic Support, West Virginia Department of Education
Janet Rorrer, EdD, Senior Director, Science, Technology and Research Division,
West Virginia Higher Education Policy Commission
Juliana Sarafin, PhD, Director Emeritus, Science, Technology and Research Division,
West Virginia Higher Education Policy Commission
Samantha Smith, BS, Manager, Business and Industrial Development, West Virginia Division of Economic Development
Kelsey Staggers, MPA, Business Development Manager, West Virginia Division of Economic Development

Regional Economic Development

David Lieving, MS, President and CEO, Huntington Area Development Council

Venture Development and Entrepreneurship Support Organizations

Ashok Aggarwal, BS, Co-Founder, M&S Consulting and Intermed Labs, 304 Angel Fund
Mike Green, MSE, Co-Founder and Managing Director, Mountain State Capital
Matt Hartsog, MSE, MBA, Director of Capital Investments, NOVA West Virginia Investment Fund
Michelle O'Connor, BS, Director, INNOVA Commercialization
Amber Ravenscroft, MSEd, Co-Chair, West Virginia Entrepreneurship Ecosystem
Ariana Shives, MS, Program Manager, TechConnectWV
Tara St. Clair, MS, Co-Chair, West Virginia Entrepreneurship Ecosystem
Andy Zulauf, MBA, Executive Director, West Virginia Jobs Investment Trust

R&D-Intensive Industry

FIGURE 1

Research and development (R&D)-intensive industries are manufacturing and service industries that have high and medium-high shares of R&D expenditures as a percentage of their value-added output, or gross domestic product (GDP). Nationally, R&D-intensive industries account for $3.3 trillion, or 11%, of U.S. GDP. This figure lists these industries and their estimated R&D intensities.

Definition of High and Medium-High R&D-Intensive Industries in the United States

NAICS 2022	INDUSTRY TITLE	R&D Intensity
High R&D Intensity: Manufacturing		
3364	Aerospace product and parts mfg.	31.69%
3254	Pharmaceutical and medicine mfg.	27.98%
334	Computer and electronic products mfg.	24.05%
333314	Optical instrument and lens mfg.*	24.05%
Medium-High R&D Intensity: Manufacturing		
3361-3363	Motor vehicle mfg.	15.36%
3391	Medical equipment and supplies mfg.	9.29%
332913, 332991	Other fabricated metal products mfg.	7.89%
3331, 3332, 3334, 3335, 3336, 3339	Machinery mfg. (agricultural, industrial, metalworking, HVAC, power transmission)	7.89%
333310	Commercial and service industry machinery mfg.	7.89%
335	Electrical equipment, appliance, and component mfg.	6.22%
3251-3353, 3255-3256, 3259	Chemical mfg., excluding pharmaceuticals	6.52%
3365, 3369	Railroad and other transportation equipment mfg.	5.72%
High R&D Intensity: Services		
5132	Software publishers	28.94%
5417	Scientific research and development services	30.39%
Medium-High R&D Intensity: Services		
5415	Computer systems design and related services	5.92%
518	Data processing, hosting, and related services	5.92%
519	Other information services	5.92%

NAICS = North American Industry Classification System; HVAC = Heating, ventilation, and air conditioning

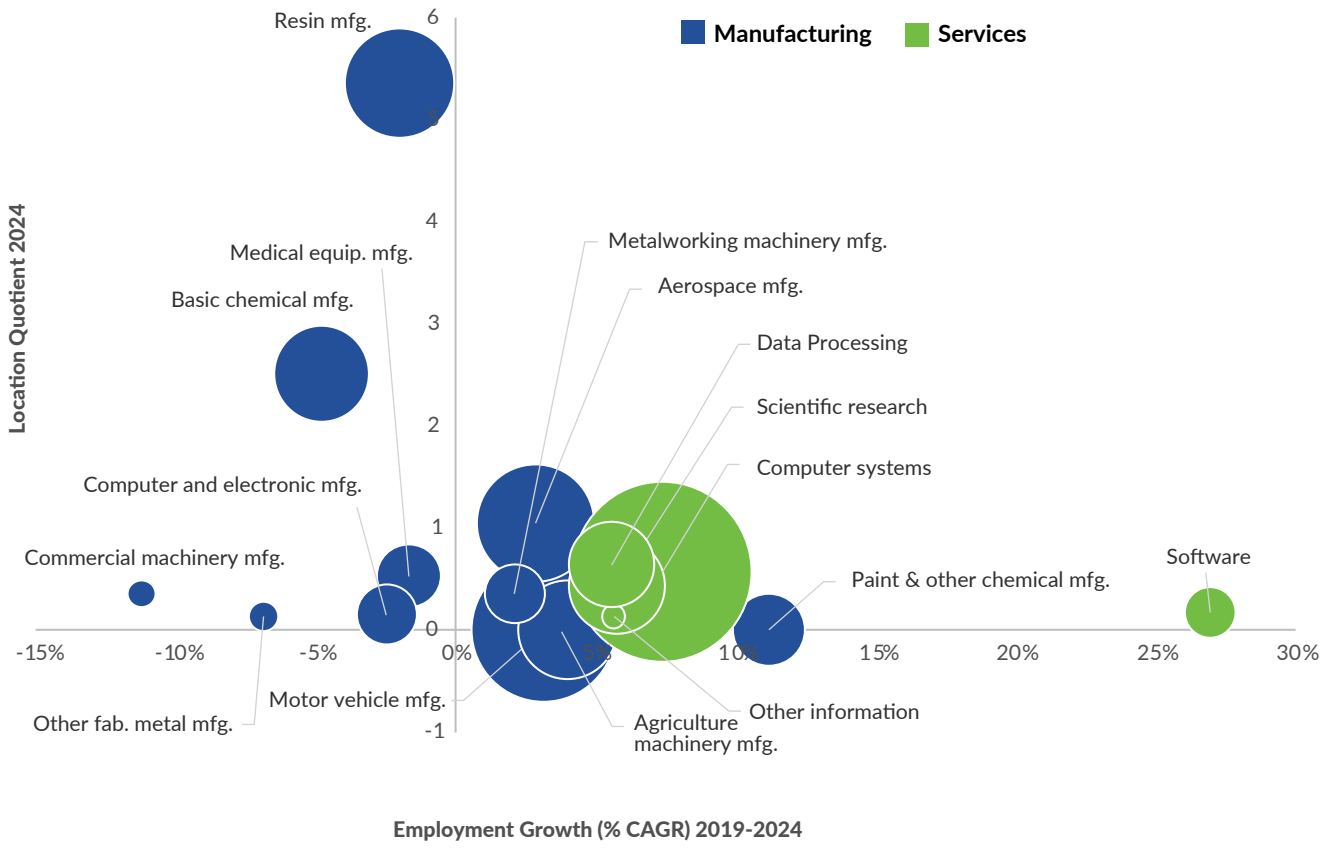
Note: *333314 was combined into 333310 in the 2022 NAICS revision

Sources: Galindo-Rueda, F. & Verger, F. (2016). OECD taxonomy of economic activities based on R&D intensity. OECD Science, Technology, and Industry *Working Papers. OECD Publishing; National Science Board (2022). SAKTI-3 Concordance for Knowledge and Technology Intensive Industry Employment.*

FIGURE 2

In this figure, the bubbles indicate the 2024 employment in each R&D-intensive manufacturing or services industry. The positioning of each bubble on the x-axis represents the compound annual growth rate (CAGR) of employment from 2019 through 2024. All the R&D-intensive services grew over 5% per year over this period. Employment in some types of manufacturing (e.g., motor vehicle, aerospace, and machinery manufacturing) grew, while employment in other types of manufacturing (e.g., basic chemicals, resins, medical equipment) declined.

West Virginia R&D-Intensive Industry Segment Employment Growth and Employment Concentration (Location Quotient), 2019—2024



Mfg. = Manufacturing; Equip. = Equipment; Fab. = Fabricated

Note: The location quotient measures how concentrated an industry's employment is in a state or region compared to the national average.

Source: U.S. Bureau of Labor Statistics (2023). Quarterly Census of Employment and Wages, multiple years.

FIGURE 3

In 2024, West Virginia's total R&D-intensive manufacturing employment (16,716 people) was greater than R&D-intensive services (9,905 people). Since 2019, West Virginia's R&D-intensive sector employment grew much faster (3.7% CAGR) than total private sector employment (0.2% CAGR). R&D-intensive services drove this growth, with 2,964 added jobs (7.4% CAGR) in the same time frame. R&D-intensive manufacturing also grew, adding 1,451 jobs (1.8% CAGR), while all manufacturing employment fell slightly (-0.4% CAGR).

Size and Growth of West Virginia's R&D-Intensive Industry Segments, 2019, 2024, 5-Year Change, 5-Year CAGR, and 2024 Location Quotient

NAICS	INDUSTRY TITLE	2019	2024	5-year Change	5-year CAGR	2024 LQ
31-33	**All Manufacturing**	**46,979**	**46,068**	**-911**	**-0.4%**	**N/A**
	R&D-Intensive Manufacturing	**15,265**	**16,716**	**1,451**	**1.8%**	**N/A**
3362, 3363	Motor vehicle body and trailer mfg.; Motor vehicle parts mfg.	3,408	3,978	570	3.1%	N/A
3364	Aerospace product and parts mfg.	2,282	2,626	344	2.8%	1.05
3252	Resin, synthetic rubber, and artificial and synthetic fibers and filaments mfg.	2,512	2,270	-242	-2.0%	5.36
3331, 3339	Agriculture, construction, and mining machinery mfg.; Other general purpose machinery mfg.	1,553	1,890	337	4.0%	N/A
3251	Basic chemical mfg.	2,226	1,741	-485	-4.8%	2.51
3255, 3259	Paint, coating, and adhesive mfg.; Other chemical product and preparation mfg.	577	980	403	11.2%	N/A
3254	Pharmaceutical and medicine mfg.	ND	800	N/A	N/A	0.51
3391	Medical equipment and supplies mfg.	838	770	-68	-1.7%	0.53
334	Computer and electronic products mfg.	792	699	-93	-2.5%	0.15
335	Metalworking machinery mfg.	598	664	66	2.1%	0.35
3329	Other fabricated metal mfg.	227	159	-68	-6.9%	0.13
33331	Commercial and service industry machinery mfg.	252	139	-113	-11.2%	0.35
	All Services	**447,900**	**457,018**	**9,118**	**0.4%**	**N/A**

NAICS	INDUSTRY TITLE	2019	2024	5-year Change	5-year CAGR	2024 LQ
	R&D-Intensive Services	**6,941**	**9,905**	**2,964**	**7.4%**	**N/A**
5415	Computer systems design and related services	4,319	6,163	1,844	7.4%	0.57
5417	Scientific research and development services	1,346	1,780	434	5.7%	0.43
518	Data processing, hosting, and related services	1,052	1,380	328	5.6%	0.64
5132	Software publishers	145	478	333	26.9%	0.17
519	Other information services	79	104	25	5.7%	0.13
	Total R&D-Intensive Industries	**22,206**	**26,621**	**4,415**	**3.7%**	**N/A**
10	**Total Private Sector Employment**	**553,809**	**559,262**	**5,453**	**0.2%**	**N/A**

NAICS = North American Industry Classification System; LQ = Location quotient; mfg. = Manufacturing

Notes: The LQ shows West Virginia's concentration of employment in an industry relative to the national average. The higher the concentration, the higher West Virginia's specialization in this industry.

All manufacturing includes all industries in NAICS 31, 32, and 33. All services includes all private sector service industries in NAICS 22, 42, 44, 45, 48, 49, 51, 52, 53, 54, 55, 56, 61, 62, 71, 72, and 81.

Source: U.S. Bureau of Labor Statistics (2024). Quarterly Census of Employment and Wages, multiple years.

STEM Talent Pipeline: Employment in STEM Jobs

FIGURE 4

Science, technology, engineering, and math (STEM) occupations include science and engineering (S&E), S&E-related (which are predominantly health care jobs), and skilled technical jobs. This figure shows the specific types of jobs included in each category based on the U.S. Bureau of Labor Statistic's definition of STEM occupations and the National Center for Science and Engineering Statistic's definition of the "skilled technical workforce."

STEM Occupation Definitions

S&E Occupations

- Computer and mathematics
- Surveyors, cartographers, and photogrammetrists
- Engineers
- Drafters, engineering technicians, and mapping technicians
- Life, physical, social scientists and related work
- Life, physical, and social science technicians
- Math, computer science, engineering, physical science teachers (postsecondary)
- Computer and information systems, architectural and engineering, and natural sciences managers
- Sales representatives, wholesale and manufacturing, technical and scientific products, and sales engineers

S&E-Related Occupations

- Diagnosing or treating practitioners (health care)
- Other health care practitioners and technical occupations
- Health technologists and technicians
- Medical and health services managers
- Architecture teachers (postsecondary)
- Health teachers (postsecondary)
- Architectural and civil drafters
- Architects (excluding naval architects)

Skilled Technical Occupations

- Supervisors of production workers
- Electrical, electronics, and electromechanical assemblers
- Bakers
- Metal workers and plastic workers
- Machinists
- Printing workers
- Textile, apparel, and furnishings, and wood workers
- Powerplant operators, distributors, and dispatchers
- Construction and extraction occupations
- Electrical and electronics equipment mechanics, installers, and repairers
- Vehicle and mobile equipment mechanics, installers, repairers
- All other installation, maintenance, and repair occupations

Note: The job titles listed in the "Skilled Technical" category are representative and do not represent the full list of occupations; the Standard Occupations Classification (SOC) codes used for this industry are the broad categories of 47, 49, and 51.

Source: U.S. Bureau of Labor Statistics (2019). Attachment B: STEM definition options, SOC Policy Committee Recommendation to Office of Management and Budget; National Center for Science and Engineering Statistics (2022). Skilled Technical Workforce Initiative.

FIGURE 5

Similar to national patterns, West Virginia STEM employment is highest in skilled technical jobs (114,310 workers in 2024), followed by S&E-related jobs (67,420 workers), and S&E jobs (30,720 workers). West Virginia STEM employment decreased slightly from 2019 to 2024, driven by declines in production/manufacturing (-2.1%) and construction (-2.4%). These declines were offset by growth in S&E and S&E-related occupations, such as health care practitioner (3.2% CAGR) and computer and mathematics occupations (3.2% CAGR) over the same period.

West Virginia Employment in STEM Occupations, 2019, 2024, 5-Year Change, and 5-Year CAGR

OCCUPATION	2019	2024	5-Year Change	5-Year CAGR
S&E	**29,170**	**30,720**	**1,550**	**1.0%**
Computer and mathematics	11,450	13,430	1,980	3.2%
Engineering	8,360	8,400	40	0.1%
Life, physical, and social sciences	5,860	5,320	-540	-1.9%
S&E management and sales occupations	1,910	2,220	310	3.1%
S&E postsecondary teachers	1,590	1,350	-240	-3.2%
S&E-Related	**61,730**	**67,420**	**5,690**	**1.8%**
Health care practitioners	34,480	40,380	5,900	3.2%
Health technicians	22,470	22,080	-390	-0.3%
Health and architect postsecondary teachers	2,370	2,390	20	0.2%
Medical and health services managers	1,710	2,100	390	4.2%
Architects and architectural drafters	700	470	-230	-7.7%
Skilled Technical	**124,240**	**114,310**	**-9,930**	**-1.7%**
Construction and extraction	49,250	43,590	-5,660	-2.4%
Production or manufacturing	39,560	35,530	-4,030	-2.1%
Installation, maintenance, and repair occupations	35,430	35,190	-240	-0.1%
STEM Total	**215,140**	**212,450**	**-2,690**	**-0.3%**
Non-STEM Total	**486,960**	**489,020**	**2,060**	**0.1%**
All Occupations	**702,100**	**701,470**	**-630**	**0.0%**

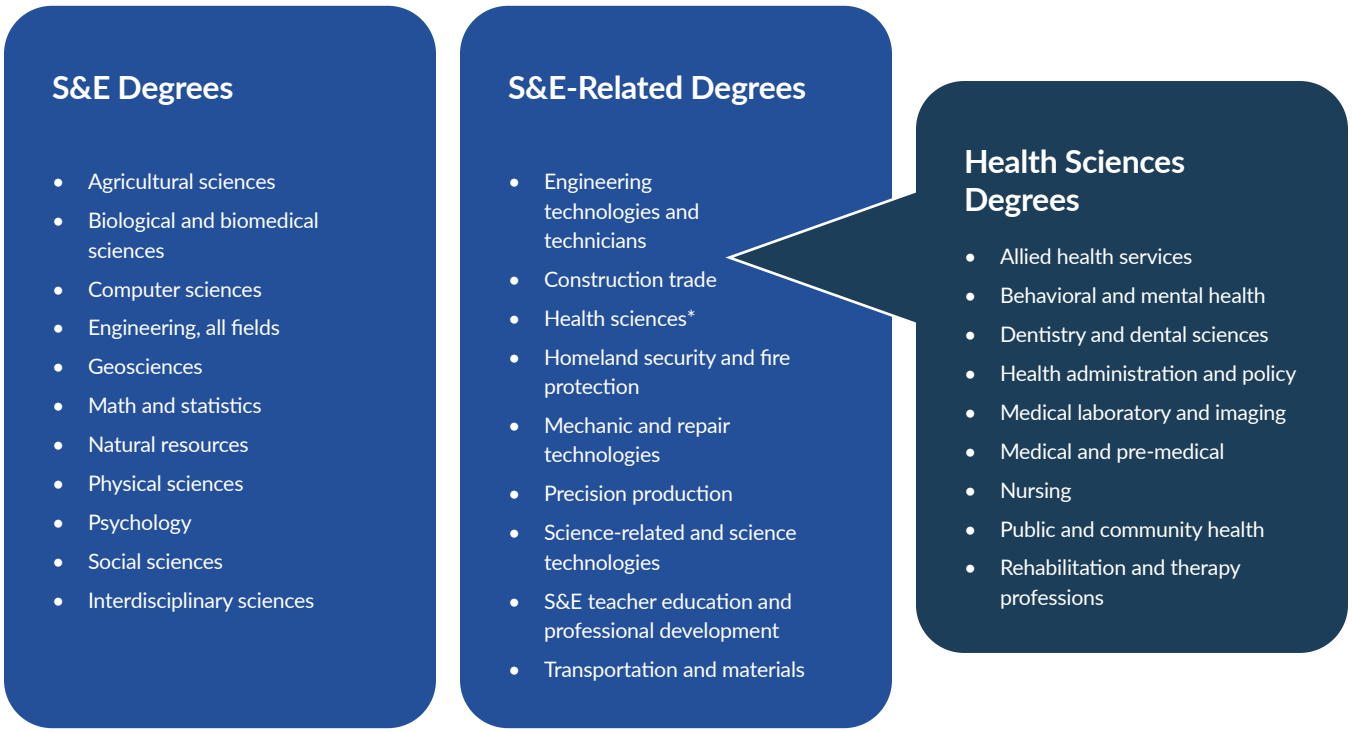
Source: U.S. Bureau of Labor Statistics (2024). Occupational Employment and Wage Statistic, multiple years.

STEM Talent Pipeline: Degrees Awarded in STEM Fields

FIGURE 6

STEM degrees are comprised of two major categories: S&E fields and S&E-related fields, including health sciences, as shown in this figure. Higher education institutions report certificates and degrees completed to the National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS). The taxonomy for classifying S&E and S&E-related degrees comes from the National Center for Science and Engineering Statistics Taxonomy of Disciplines. For the West Virginia S&T Plan, RTI did not include social sciences in the S&E category. Additionally, due to the large volume of degree completions in health sciences, RTI pulled these degrees out from S&E-related fields into their own category.

STEM Degree Categories



*RTI pulled Health Sciencse degrees out from S&E-related degrees into a separate category for analytical purposes.

Source: National Center for Science and Engineering Statistics (2025). Taxonomy of Science & Engineering and Science Disciplines.

FIGURE 7

In 2023, there were 20,442 certificates, associate, bachelor's, master's, and doctoral degrees awarded in West Virginia, 1,838 fewer completions than in 2018. The share of students completing S&E degrees and S&E-related degrees is smaller than those completing non-S&E and health sciences certificates and degrees. Between 2018 and 2023, the number of S&E degrees awarded declined by 232 and S&E-related degrees awarded declined by 125. By comparison, the number of health science degrees awarded grew by 160. The number of non-S&E degrees awarded (-3.5% CAGR) fell more rapidly than S&E degrees awarded (-1.3% CAGR).

West Virginia Total Degrees Awarded in S&E, S&E-Related, Health Sciences, and Non-S&E Disciplines, 2018, 2023, 5-Year Change, and 5-Year CAGR

DEGREE CLASSIFICATIONS	2018	2023	5-Year Change	5-Year CAGR (%)
Non-S&E	**11,622**	**9,744**	**-1,878**	**-3.5%**
Certificates or 12-month programs	951	743	-208	-4.8%
Associate degrees	1,957	1,582	-375	-4.2%
Bachelor's degrees	6,292	5,195	-1,097	-3.8%
Master's degrees	2,228	2,001	-227	-2.1%
Doctoral degrees	194	223	29	2.8%
Health Sciences	**5,481**	**5,641**	**160**	**0.6%**
Certificates or 12-month programs	1,261	1,032	-229	-3.9%
Associate degrees	1,492	1,564	72	0.9%
Bachelor's degrees	1,471	1,729	258	3.3%
Master's degrees	442	546	104	4.3%
Doctoral degrees (professional practice)	792	748	-44	-1.1%
Doctoral degrees (research scholarship)	23	22	-1	-0.9%
S&E	**3,661**	**3,429**	**-232**	**-1.3%**
Certificates or 12-month programs	95	119	24	4.6%
Associate degrees	344	295	-49	-3.0%
Bachelor's degrees	2,675	2,509	-166	-1.3%
Master's degrees	425	353	-72	-3.6%
Doctoral degrees	122	153	31	4.6%
S&E-Related	**1,753**	**1,628**	**-125**	**-1.5%**
Certificates or 12-month programs	1,015	914	-101	-2.1%
Associate degrees	430	307	-123	-6.5%
Bachelor's degrees	261	259	-2	-0.2%
Master's degrees	47	144	97	25.1%
Doctoral degrees	N/A	4	N/A	N/A
Total	**22,280**	**20,442**	**-1,838**	**-1.7%**

Notes: All certificates and degrees conferred are for the academic year (July to June). Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 8

West Virginia institutions of higher education reported 2,065 certificate and 12-month program completions in 2023. Certificates represented 56% of all S&E-related degrees, 18% of health sciences degrees, and 3.5% of all S&E degrees in 2023. S&E certificates increased from 2018 to 2023, driven largely by growth in computer and information services. By comparison, S&E-related certificate completions declined, primarily due to declines in science technician (-455) and HVAC technician (-51) programs. However, engineering technician certificates (+286) and transportation certificates grew (+158). Certificates in health science declined (-229).

West Virginia Certificates or 12-Month Programs Awarded in S&E and S&E-Related Disciplines, 2018, 2023, 5-Year Change, and 5-Year CAGR

CERTIFICATES OR 12-MONTH PROGRAMS	2018	2023	5-Year Change	5-Year CAGR
Health Sciences	**1,261**	**1,032**	**-229**	**-3.9%**
S&E-Related	**1,015**	**914**	**-101**	**-2.1%**
Engineering/engineering-related technologies/technicians		286	N/A	N/A
Ground transportation (CDL truck driver)	56	214	158	30.8%
Electrical and power transmission installers	97	125	28	5.2%
Precision metal working	64	74	10	2.9%
Vehicle maintenance and repair technologies/technicians	66	62	-4	-1.2%
Heating, air conditioning maintenance technology/technician	105	54	-51	-12.5%
Electromechanical technologies/technicians	38	20	-18	-12.0%
Heavy/industrial equipment maintenance technologies/technicians	6	16	10	21.7%
Electrical/electronic maintenance and repair technologies/technicians	19	15	-4	-4.6%
Drafting/design engineering technologies/technicians	8	14	6	11.8%
Electrical/electronic engineering technologies/technicians	15	13	-2	-2.8%
Industrial production technologies/technicians	29	9	-20	-20.9%
Mining and petroleum technologies/technicians	9	5	-4	-11.1%
Engineering-related technologies/technicians	1	1	0	N/A
Computer engineering technologies/technicians		1	N/A	N/A
Science technologies/technicians, general		1	N/A	N/A
Science technologies/technicians, other	456	1	-455	-70.6%

CERTIFICATES OR 12-MONTH PROGRAMS	2018	2023	5-Year Change	5-Year CAGR
Physical science technologies/technicians	9	1	-8	-35.6%
Data entry/microcomputer applications	2	1	-1	-12.9%
Homeland Security, law enforcement, firefighting, and related protective services, other		1	N/A	N/A
Construction engineering technology/technician	1		N/A	N/A
Environmental control technologies/technicians	15		N/A	N/A
Transportation and materials moving, other	5		N/A	N/A
Carpenters	1		N/A	N/A
Plumbing and related water supply services	3		N/A	N/A
Building/construction finishing, management, and inspection	3		N/A	N/A
Precision production, other	1		N/A	N/A
Homeland Security	2		N/A	N/A
Security science and technology	4		N/A	N/A
S&E	**95**	**119**	**24**	**4.6%**
Science	**94**	**119**	**25**	**4.8%**
Computer and information services	84	107	23	5.0%
Agricultural and veterinary sciences	10	12	2	3.7%
Engineering	**1**	**NA**	**NA**	**NA**
Total	**2,371**	**2,065**	**-306**	**-2.7%**

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 9

Community and technical colleges play an important role in West Virginia, as they offer students cost- and time-effective options for studying S&E, S&E-related, and health sciences disciplines. This figure shows the top five West Virginia community and technical colleges by number of certificates or 12-month programs completed in 2023.

West Virginia Certificates or 12-Month Degrees Awarded in S&E and S&E-Related Disciplines by Top Five Institutions, 2018, 2023, and 5-Year Change

INSTITUTION NAME AND DISCIPLINES	2018	2023	5-Year Change
S&E-Related			
Pierpont Community and Technical College	**8**	**330**	**322**
Engineering/engineering-related technologies/technicians		286	N/A
Vehicle maintenance and repair technologies/technicians		29	N/A
Drafting/design engineering technologies/technicians		13	N/A
Mining and petroleum technologies/technicians	8	2	-6
James Rumsey Technical Institute	**69**	**108**	**39**
Ground transportation	25	47	22
Electrical and power transmission installers	14	33	19
Heating, air conditioning maintenance technician	12	17	5
Vehicle maintenance and repair technologies/technicians	14	11	-3
Electromechanical technologies/technicians	4		N/A
Boone Career and Technical Center		**105**	**105**
Ground transportation		98	98
Precision metal working		7	7
New River Community and Technical College	**42**	**72**	**30**
Electrical and power transmission installers	17	29	12
Precision metal working	2	26	24
Vehicle maintenance and repair technologies/technicians	6	13	7
Industrial production technologies/technicians		3	N/A
Science technologies/technicians, other	17	1	-16

INSTITUTION NAME AND DISCIPLINES	2018	2023	5-Year Change
Fred W Eberle Technical Center	**66**	**59**	**-7**
Ground transportation	31	36	5
Electrical and power transmission installers	14	17	3
Precision metal working	10	6	-4
Construction engineering technology/technicians	1		N/A
Vehicle maintenance and repair technologies/technicians	10		N/A
S&E			
Valley College-Martinsburg		**41**	**N/A**
Computer and information services*		41	N/A
Blue Ridge Community and Technical College	**14**	**18**	**4**
Computer and information services	8	17	9
Agricultural and veterinary sciences	5	1	-4
Other engineering	1		N/A
Pierpont Community and Technical College	**5**	**17**	**12**
Computer and information services	1	17	16
Agricultural and veterinary sciences	4		N/A
Mountwest Community and Technical College	**26**	**14**	**-12**
Computer and information services	26	14	-12
Carver Career Center	**1**	**11**	**10**
Agricultural and veterinary sciences	1	11	10

* In 2022, Valley College-Martinsburg started a new computer and information services program.

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 10

In 2023, there were 2,166 associate degrees awarded in West Virginia. Nearly three-quarters (1,564) were in health science programs. S&E-related programs had the second-largest group, with 307 completions, followed by S&E programs with 295 completions. The number of associate degrees awarded in each category, except health sciences, declined from 2018 to 2023.

West Virginia Associate Degrees Awarded in S&E and S&E-Related Disciplines, 2018, 2023, 5-Year Change, and 5-Year CAGR

ASSOCIATE DEGREES	2018	2023	5-Year Change	5-Year CAGR
Health Sciences	**1,492**	**1,564**	**72**	**0.9%**
S&E-Related	**430**	**307**	**-123**	**-6.5%**
Vehicle maintenance and repair technologies/technicians	23	46	23	14.9%
Electrical/electronic engineering technologies/technicians	49	39	-10	-4.5%
Precision metal working	61	37	-24	-9.5%
Electrical and power transmission installers	45	24	-21	-11.8%
Construction engineering technology/technician	12	22	10	12.9%
Electromechanical technologies/technicians	45	21	-24	-14.1%
Science technologies/technicians, other	52	14	-38	-23.1%
Engineering/engineering-related technologies/technicians, other	16	14	-2	-2.6%
Industrial production technologies/technicians	9	11	2	4.1%
Civil engineering technologies/technicians	19	9	-10	-13.9%
Mechanical engineering–related technologies/technicians	11	8	-3	-6.2%
Physical science technologies/technicians	23	8	-15	-19.0%
Heating, air conditioning maintenance technology/technicians	5	7	2	7.0%
Drafting/design engineering technologies/technicians	8	6	-2	-5.6%
Mining and petroleum technologies/technicians	13	6	-7	-14.3%
Engineering-related technologies/technicians	10	6	-4	-9.7%
Building/construction finishing, management, and inspection	4	5	1	4.6%
Mechanic and repair technologies/technicians, other		5	N/A	N/A
Mechanics and repairers, general	12	4	-8	-19.7%

ASSOCIATE DEGREES	2018	2023	5-Year Change	5-Year CAGR
Environmental control technologies/technicians		3	N/A	N/A
Engineering technologies/technicians, general		3	N/A 3	N/A
Electrical/electronic maintenance and repair technicians		3	N/A	N/A
Quality control and safety technologies/technicians	9	3	-6	-19.7%
Security science and technology		2	N/A	N/A
Architectural engineering technologies/technicians		1	N/A	N/A
Data entry/microcomputer applications	4		N/A	N/A
S&E	**344**	**295**	**-49**	**-3.0%**
Science	**335**	**293**	**-42**	**-2.6%**
Computer information systems	251	230	-21	-1.7%
Agricultural and veterinary sciences	61	44	-17	-6.3%
Natural resource	20	15	-5	-5.6%
Biological and biomedical	3	4	1	5.9%
Engineering	**9**	**2**	**-7**	**-26.0%**
Total	**2,266**	**2,166**	**-100**	**-0.9%**

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 11

BridgeValley Community and Technical College and Pierpont Community and Technical College had the most graduates of S&E-related associate degree programs in 2023. Vehicle maintenance, electrical technician, precision metalworking, electrical and power transmission, and construction programs were the most popular degrees (see Figure 10). Blue Ridge Community and Technical College and BridgeValley Community and Technical College had the most graduates of S&E associate degree programs. Computer information systems programs were the most popular S&E associate degree programs.

West Virginia Associate Degrees Awarded in S&E and S&E-Related Disciplines by Top Five Schools, 2018, 2023, 5-Year Change, and 5-Year CAGR

INSTITUTION NAME AND DISCIPLINES	2018	2023	5-Year Change
S&E-Related			
BridgeValley Community and Technical College	**108**	**72**	**-36**
Construction engineering technology/technician	12	22	10
Electromechanical technologies/technicians	6	12	6
Electrical/electronic engineering technologies/technicians	12	11	-1
Vehicle maintenance and repair technologies/technicians	14	8	-6
Physical science technologies/technicians	23	8	-15
Building/construction finishing, management, and inspection	4	5	1
Precision metal working	10	3	-7
Science technologies/technicians, other	12	2	-10
Civil engineering technologies/technicians	5	1	-4
Mechanical engineering–related technologies/technicians	2		N/A
Industrial production technologies/technicians	5		N/A
Drafting/design engineering technologies/technicians	2		N/A
Engineering-related technologies/technicians	1		N/A
Pierpont Community and Technical College	**81**	**64**	**-17**
Vehicle maintenance and repair technologies/technicians	7	26	19
Engineering/engineering-related technologies/technicians, other	16	14	-2
Electrical and power transmission installers	27	12	-15

INSTITUTION NAME AND DISCIPLINES	2018	2023	5-Year Change
Drafting/design engineering technologies/technicians	6	6	0
Mining and petroleum technologies/technicians	10	3	N/A
Industrial production technologies/technicians		3	N/A
Science technologies/technicians, other	15		N/A
Mountwest Community and Technical College	**41**	**30**	**-11**
Precision metal working	13	16	3
Science technologies/technicians, other	6	6	0
Electrical/electronic engineering technologies/technicians	11	4	-7
Industrial production technologies/technicians	3	2	-1
Electromechanical technologies/technicians	8	1	-7
Security science and technology		1	N/A
Bluefield State University	**31**	**25**	**-6**
Electrical/electronic engineering technologies/technicians	12	9	-3
Mechanical engineering–related technologies/technicians	9	8	-1
Civil engineering technologies/technicians	10	8	-2
Blue Ridge Community and Technical College	**34**	**24**	**-10**
Electrical and power transmission installers	18	12	-6
Environmental control technologies/technicians		3	N/A
Engineering technologies/technicians, general		3	N/A
Electromechanical technologies/technicians	9	3	-6
Electrical/electronic engineering technologies/technicians	2	2	0
Industrial production technologies/technicians		1	N/A
Data entry/microcomputer applications	4		N/A
Science technologies/technicians, other	1		N/A
S&E			
Blue Ridge Community and Technical College	**40**	**63**	**23**
Computer information systems	40	58	18
Agricultural sciences		5	N/A

INSTITUTION NAME AND DISCIPLINES	2018	2023	5-Year Change
BridgeValley Community and Technical College	**29**	**40**	**11**
Computer information systems	23	30	7
Agricultural sciences	6	10	4
Potomac State College of West Virginia University	**47**	**30**	**-17**
Agricultural and veterinary sciences	26	15	-11
Information sciences	3	8	5
Natural resources and conservation	9	5	-4
Engineering, general	9	2	-7
Pierpont Community and Technical College	**33**	**24**	**-9**
Computer information systems	19	15	-4
Agricultural and veterinary sciences	14	9	-5
Mountwest Community and Technical College	**36**	**20**	**-16**
Computer information systems	29	15	-14
Agricultural and veterinary sciences	7	5	-2

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 12

In 2023, there were 9,692 bachelor's degree completions across all fields in West Virginia. The number of bachelor's degrees awarded declined in both S&E and non-S&E fields, but non-S&E degrees awarded declined at a faster rate (-3.8% CAGR vs. -1.3% CAGR). Within S&E fields, bachelor's degrees in science totaled 1,806, and bachelor's degrees in engineering totaled 703. Although overall science program completions declined, the number of biological and biomedical sciences degrees and computer sciences degrees awarded grew from 2018 to 2023 (by 127 and 10, respectively).

West Virginia Bachelor's Degrees Awarded in S&E and S&E-Related Disciplines, 2018, 2023, 5-Year Change, and 5-Year CAGR

BACHELOR'S DEGREES	2018	2023	5-Year Change	5-Year CAGR
Non-S&E	**6,292**	**5,195**	**-1,097**	**-3.8%**
S&E	**2,675**	**2,509**	**-166**	**-1.3%**
Science	**1,844**	**1,806**	**-38**	**-0.4%**
Biological and biomedical sciences	539	666	127	4.3%
Psychology	500	426	-74	-3.2%
Computer sciences	211	221	10	0.9%
Agricultural sciences	177	175	-2	-0.2%
Natural resources and conservation	183	163	-20	-2.3%
Physical and geosciences	165	117	-48	-6.6%
Math and statistics	69	38	-31	-11.2%
Engineering	**831**	**703**	**-128**	**-3.3%**
Mechanical engineering	206	187	-19	-1.9%
Civil engineering	114	112	-2	-0.4%
Aerospace engineering	60	80	20	5.9%
Industrial engineering	99	70	-29	-6.7%
Other engineering	171	67	-104	-17.1%
Biomedical/medical engineering	21	51	30	19.4%
Computer and electrical engineering	94	91	-3	-0.6%
Chemical engineering	66	45	-21	-7.4%
Health Sciences	**1,471**	**1,729**	**258**	**3.3%**
S&E-Related	**261**	**259**	**-2**	**-0.2%**

BACHELOR'S DEGREES	2018	2023	5-Year Change	5-Year CAGR
Security science and technology	66	144	78	16.9%
Mechanical engineering–related technologies/technicians	62	28	-34	-14.7%
Quality control and safety technologies/technicians	23	27	4	3.3%
Civil engineering technologies/technicians	28	16	-12	-10.6%
S&E teacher education and professional development	29	16	-13	-11.2%
Engineering-related fields	24	11	-13	-14.4%
Electrical/electronic engineering technologies/technicians	16	7	-9	-15.2%
Air transportation		7	N/A	N/A
Engineering technologies/technicians, general	3	3	0	N/A
Architectural engineering technologies/technicians	9		N/A	N/A
Total	**10,699**	**9,692**	**-1,007**	**-2.0%**

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 13

In 2023, West Virginia institutions of higher education awarded 3,044 master's degrees across all fields. S&E master's degrees, which declined from 425 in 2018 to 353 in 2023, represented 12% of the total. Within S&E, engineering degrees decreased at a faster rate (-9.4% CAGR) than science degrees (-0.5% CAGR). S&E-related fields and health sciences both saw growth in master's degrees awarded, by 25.1% CAGR and 4.3% CAGR respectively.

West Virginia Master's Degrees Awarded in S&E and S&E-Related Disciplines, 2018, 2023, 5-Year Change, and 5-Year CAGR

MASTER'S DEGREES	2018	2023	5-Year Change	5-Year CAGR
Non-S&E	**2,228**	**2,001**	**-227**	**-2.1%**
Health Sciences	**442**	**546**	**104**	**4.3%**
S&E	**425**	**353**	**-72**	**-3.6%**
Science	**258**	**251**	**-7**	**-0.5%**
Biological and biomedical sciences	42	71	29	11.1%
Computer sciences	68	58	-10	-3.1%
Psychology	49	58	9	3.4%
Math and statistics	27	21	-6	-4.9%
Natural resources and conservation	27	16	-11	-9.9%
Agricultural sciences	32	16	-16	-12.9%
Physical sciences	13	11	-2	-3.3%
Engineering	**167**	**102**	**-65**	**-9.4%**
Computer and electrical engineering	31	30	-1	-0.7%
Civil engineering	22	17	-5	-5.0%
Mechanical engineering	24	16	-8	-7.8%
Other engineering	69	25	-44	-18.4%
Industrial engineering	11	7	-4	-8.6%
Aerospace engineering	7	3	-4	-15.6%
Chemical engineering	3	3	0	0.0%
Biomedical/medical engineering		1	N/A	NA
S&E-Related	**47**	**144**	**97**	**25.1%**
Security science and technology	23	87	64	30.5%
Quality control and safety technologies/technicians	22	49	27	17.4%
Engineering-related fields		5	N/A	N/A
S&E teacher education and professional development	2	3	1	8.4%
Total	**3,142**	**3,044**	**-98**	**-0.6%**

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 14

In 2023, West Virginia institutions of higher education awarded 1,150 doctoral degrees across all fields—an increase of 19 from 2018. Most (770 doctoral degrees) were in health sciences fields, and the number awarded declined by 45 since 2018. West Virginia awarded 153 S&E doctoral degrees in 2023, which represented an increase of 31 degrees from 2018. Doctoral degrees awarded in the biological and biomedical sciences, computer sciences, psychology, physical sciences, and engineering drove S&E growth. This growth in doctoral programs supported strong growth in academic research over this 5-year period (see figure 19).

West Virginia Doctoral Degrees Awarded in S&E and S&E-Related Disciplines, 2018, 2023, 5-Year Change, and 5-Year CAGR

DOCTORAL DEGREES	2018	2023	5-Year Change	5-Year CAGR
Health Sciences	**815**	**770**	**-45**	**-1.1%**
Non-S&E	**194**	**223**	**29**	**2.8%**
S&E	**122**	**153**	**31**	**4.6%**
Science	**84**	**111**	**27**	**5.7%**
Biological and biomedical sciences	18	30	12	10.8%
Psychology	24	30	6	4.6%
Physical sciences	20	25	5	4.6%
Math and statistics	10	10	0	0.0%
Computer sciences	1	8	7	51.6%
Agricultural sciences	4	5	1	4.6%
Natural resources and conservation	7	3	-4	-15.6%
Engineering	**38**	**42**	**4**	**2.0%**
S&E-Related	**N/A**	**4**	**N/A**	**N/A**
Homeland Security and fire protection	N/A	4	N/A	N/A
Total	**1,131**	**1,150**	**19**	**0.3%**

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 15

Five public institutions in West Virginia awarded 703 bachelor's degrees in engineering in 2023. Mechanical, civil, and computer and electrical engineering were the most popular fields. At the graduate level, West Virginia University awarded all 42 engineering doctoral degrees in 2023. West Virginia University also awarded 87 master's degrees in engineering, followed by Marshall University, which awarded 15 master's degrees in engineering.

Bachelor's, Master's, and Doctoral Engineering Degree Completions by West Virginia Public Higher Education Institutions, 2023

INSTITUTION NAME AND ENGINEERING DISCIPLINES	Bachelor's	Master's	Doctoral
West Virginia University	**607**	**87**	**42**
Mechanical engineering	161	14	
Civil engineering	82	17	
Aerospace engineering	80	3	
Computer and electrical engineering	72	26	
Industrial engineering	70	7	
Other engineering	54	16	42
Biomedical/medical engineering	46	1	
Chemical engineering	42	3	
Marshall University	**52**	**15**	
Civil engineering	19		
Mechanical engineering	16	2	
Computer and electrical engineering	9	4	
Biomedical/medical engineering	5		
Other engineering	3	9	
West Virginia University Institute of Technology	**31**		
Civil engineering	11		
Mechanical engineering	10		
Computer and electrical engineering	7		
Chemical engineering	3		
Shepherd University	**9**		
Other engineering	6		
Computer and electrical engineering	3		
Fairmont State University	**4**		
Other engineering	4		
Total	**703**	**102**	**42**

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis. Institutions and S&E fields are sorted from highest to lowest number of bachelor's degrees awarded. A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Reasons an institution may not report: a program may not have existed prior to 2023; there were no graduates/completions from a program in a given year; or the institution did not report to IPEDS in that year.

Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

FIGURE 16

There are seven West Virginia institutions of higher education that each produce 50 or more graduates with bachelor of science degrees annually. The largest numbers of bachelor's and master's degrees are in the same three fields: biological and biomedical sciences, psychology, and computer sciences. Biological and biomedical sciences, psychology, and the physical sciences were the top three fields for doctoral degrees awarded in 2023.

Bachelor's, Master's, and Doctoral Science Degrees Awarded by West Virginia Public Higher Education Institutions, 2023

INSTITUTION NAME AND SCIENCE DISCIPLINES	Bachelor's	Master's	Doctoral
West Virginia University	**978**	**143**	**95**
Biological and biomedical sciences	393	29	28
Agricultural sciences	175	16	5
Psychology	155	17	16
Natural resources and conservation	116	16	3
Computer sciences	84	39	8
Physical sciences	34	8	25
Math and statistics	21	18	10
Marshall University	**246**	**73**	**16**
Psychology	102	39	14
Biological and biomedical sciences	68	16	2
Computer sciences	35	12	
Physical sciences	17	3	
Natural resources and conservation	12		
Geosciences	11		
Math and statistics	1	3	
Shepherd University	**100**	**1**	
Psychology	25		
Computer Sciences	24	1	
Biological and Biomedical Sciences	23		
Natural Resources and Conservation	16		
Physical Sciences	8		
Math and Statistics	4		
Fairmont State University	**71**		
Psychology	32		
Computer sciences	19		
Biological and biomedical sciences	13		
Physical sciences	5		

INSTITUTION NAME AND SCIENCE DISCIPLINES	Bachelor's	Master's	Doctoral
Math and statistics	2		
West Virginia University Institute of Technology	**58**		
Biological and biomedical sciences	23		
Psychology	17		
Computer sciences	14		
Math and statistics	2		
Physical sciences	2		
West Liberty University	**54**	**22**	
Biological and biomedical sciences	41	20	
Psychology	12	2	
Physical sciences	1		
Concord University	**53**		
Biological and biomedical sciences	24		
Computer sciences	12		
Psychology	11		
Physical sciences	5		
Math and statistics	1		
West Virginia State University	**32**	**6**	
Biological and biomedical sciences	13	6	
Psychology	11		
Physical sciences	4		
Computer sciences	3		
Math and statistics	1		
Glenville State University	**17**		
Natural resources and conservation	12		
Physical sciences	3		
Biological and biomedical sciences	2		
Bluefield State University	4		
Computer sciences	4		
Total	**1,613**	**245**	**111**

Notes: All certificates and degrees conferred are for the academic year (July to June). A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Any accredited higher education institutions that closed during the 2018-2023 period were not included in the trend analysis. Institutions and S&E fields are sorted from highest to lowest number of bachelor's degrees awarded. A blank or missing field indicates that no data were reported for that specific item or survey component by the institution. Reasons an institution may not report: a program may not have existed prior to 2023; there were no graduates/completions from a program in a given year; or the institution did not report to IPEDS in that year.

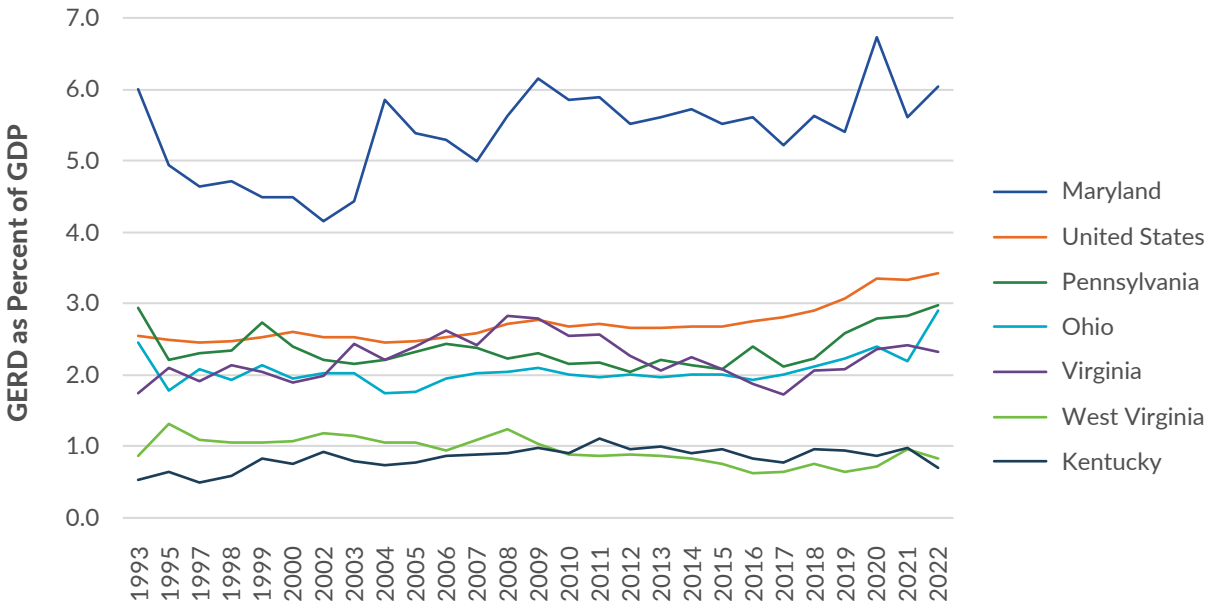
Source: National Center of Education Statistics (2024). Integrated Postsecondary Education Data System Completions Survey, multiple years.

Research Competitiveness

FIGURE 17

Companies, universities, government, and nonprofit research organizations perform R&D. The higher the R&D intensity (defined as total R&D expenditures relative to GDP), the more technology-intensive an economy is. The average R&D intensity of an Organization for Economic Cooperation and Development (OECD) member country is 2.67%. The U.S. R&D intensity is higher, at 3.43%. West Virginia's R&D Intensity was 0.83% in 2022, which is lower than the R&D intensity of neighboring states Maryland (6.03%), Pennsylvania (2.98%), Ohio (2.91%), and Virginia (2.33%), but higher than Kentucky's R&D intensity (0.71%).

Comparison of U.S., West Virginia, and Select Neighboring States' R&D Intensity (Gross Expenditures on R&D as a Share of GDP), 1993–2022



GERD = Gross expenditures on R&D

Source: National Science Board (2023). State Science and Engineering Indicators.

FIGURE 18

West Virginia ranks 20th out of the 25 National Science Foundation (NSF) Established Program to Stimulate Competitive Research (EPSCoR) states for business R&D expenditures. In 2022, West Virginia companies reported $444 million of business R&D expenditures, which represents 16.9% growth per year from 2018. By comparison, the average growth in business R&D expenditures across all EPSCoR states was 4.1% per year from 2018 to 2022.

Total Business R&D Expenditures and CAGR in EPSCoR States, 2013, 2018, and 2022

STATE	Rank	Total Business R&D Expenditures ($M)			CAGR (%)	
	2022	2013	2018	2022	9-year	4-year
Iowa	1	$2,052	$3,315	$3,257	5.3%	-0.4%
Idaho	2	$1,238	$2,556	$2,883	9.8%	3.1%
Delaware	3	$2,310	$2,375	$2,874	2.5%	4.9%
South Carolina	4	$1,016	$1,670	$2,319	9.6%	8.6%
Alabama	5	$1,563	$2,236	$2,259	4.2%	0.3%
Kansas	6	$1,942	$2,593	$2,219	1.5%	-3.8%
Oklahoma	7	$505	$868	$1,820	15.3%	20.3%
New Mexico	8	$519	$699	$1,514	12.6%	21.3%
Nevada	9	$525	$960	$1,471	12.1%	11.3%
New Hampshire	10	$2,045	$2,566	$1,449	-3.8%	-13.3%
Nebraska	11	$627	$570	$1,395	9.3%	25.1%
Kentucky	12	$1,279	$1,435	$925	-3.5%	-10.4%
Vermont	13	$406	$300	$614	4.7%	19.6%
Maine	14	$365	$285	$597	5.6%	20.3%
Rhode Island	15	$571	$703	$594	0.4%	-4.1%
Arkansas	16	$288	$471	$545	7.3%	3.7%
Louisiana	17	$354	$415	$530	4.6%	6.3%
North Dakota	18	$229	$312	$454	7.9%	9.8%
Hawaii	19	$214	$146	$447	8.5%	32.3%
West Virginia	**20**	**$306**	**$238**	**$444**	**4.2%**	**16.9%**
Mississippi	21	$211	$276	$442	8.6%	12.5%
Montana	22	$92	$180	$376	16.9%	20.2%
South Dakota	23	$164	$201	$201	2.3%	0.0%
Alaska	24	$46	$25	$189	17.0%	65.8%
Wyoming	25	$28	$39	$78	12.1%	18.9%
Total EPSCoR		**$18,895**	**$25,434**	**$29,896**	**5.2%**	**4.1%**

Note: These data do not include the U.S. territories Guam, the Virgin Islands, and Puerto Rico.

Source: National Center for Science and Engineering Statistics (2024). Business Research and Development Survey, multiple years.

FIGURE 19

Academic R&D expenditures come from a variety of sources: federal, state, institutional, industry, and nonprofit organizations. Sustained periods of high annual growth in total academic R&D expenditures drive a state's ranking. West Virginia ranked 19th out of 28 EPSCoR states and territories. Its past 10- and 5-year growth rates have been approaching the EPSCoR average growth rates but are still below them.

Total Academic R&D Expenditures and CAGR in EPSCoR States and Territories, 2013, 2018, and 2023

STATE	Rank	Total R&D Expenditures ($M)			CAGR (%)	
	2023	2013	2018	2023	10-year	5-year
Alabama	1	$837.9	$1,052.5	$1,579.5	6.5%	8.5%
Iowa	2	$714.4	$885.9	$1,102.5	4.4%	4.5%
Louisiana	3	$671.6	$744.3	$1,064.4	4.7%	7.4%
Kansas	4	$545.4	$640.7	$1,054.0	6.8%	10.5%
South Carolina	5	$648.1	$736.3	$919.0	3.6%	4.5%
Kentucky	6	$550.9	$596.5	$756.5	3.2%	4.9%
Oklahoma	7	$420.1	$517.3	$725.0	5.6%	7.0%
Nebraska	8	$444.9	$535.9	$680.3	4.3%	4.9%
Mississippi	9	$416.8	$479.4	$608.2	3.9%	4.9%
New Hampshire	10	$354.3	$471.3	$590.5	5.2%	4.6%
New Mexico	11	$403.8	$369.9	$564.6	3.4%	8.8%
Rhode Island	12	$479.2	$369.8	$513.8	0.7%	6.8%
Delaware	13	$197.3	$207.6	$461.6	8.9%	17.3%
Arkansas	14	$294.6	$343.1	$457.8	4.5%	5.9%
Montana	15	$186.0	$230.1	$382.0	7.5%	10.7%
North Dakota	16	$219.1	$255.5	$373.9	5.5%	7.9%
Hawaii	17	$343.8	$298.0	$339.7	-0.1%	2.7%
Nevada	18	$153.4	$260.1	$325.8	7.8%	4.6%
West Virginia	**19**	**$196.5**	**$211.7**	**$286.6**	**3.8%**	**6.2%**
Alaska	20	$184.5	$165.2	$241.5	2.7%	7.9%
Vermont	21	$121.1	$131.7	$238.4	7.0%	12.6%
Maine	22	$104.6	$128.5	$211.3	7.3%	10.5%
Idaho	23	$143.7	$171.1	$206.4	3.7%	3.8%
Wyoming	24	$65.5	$113.1	$150.1	8.6%	5.8%
South Dakota	25	$117.4	$115.9	$129.0	1.0%	2.2%
Puerto Rico	26	$135.7	$103.9	$115.7	-1.6%	2.2%
Guam	27	$6.0	$11.2	$22.4	14.0%	14.8%
Virgin Islands	28	$20.0	$12.0	$20.3	0.1%	11.1%
Total EPSCoR		**$8,976.4**	**$10,158.4**	**$14,120.9**	**4.6%**	**6.8%**

Note: The EPSCoR program supports states and territories that received 0.75% or less of total NSF research funding over the most recent 3-year period. The data presented for each state and territory include all public, private, and Tribal colleges that respond to the Higher Education R&D Survey.

Source: National Center for Science and Engineering Statistics (2024). Higher Education R&D Survey, multiple years.

FIGURE 20

West Virginia University and Marshall University drove growth in academic R&D expenditures over the most recent 5-year period. From 2019 to 2024, R&D grew from $187.5 million to $259.1 million and $19.6 million to $39.2 million, respectively.

West Virginia Academic R&D Expenditures ($M) by Institution, 2014, 2019–2024, and 10- and 5-Year CAGRs

INSTITUTION	Year							CAGR (%)	
	2014	2019	2020	2021	2022	2023	2024*	10-year	5- year
West Virginia University	$164.5	$187.5	$188.5	$199.9	$214.1	$246.2	$259.1	4.6%	6.7%
Marshall University	$20.4	$19.6	$22.3	$23.6	$25.7	$33.7	$39.2	6.8%	14.8%
West Virginia State University	$7.2	$5.8	$5.8	$6.6	$6.7	$5.2	$6.1	-1.7%	0.8%
West Virginia School of Osteopathic Medicine			$1.3	$1.3	$1.3	$1.5	N/A	N/A	N/A
University of Charleston					$0.2		N/A	N/A	N/A
Wheeling University	$3.3						N/A	N/A	N/A
West Liberty University	$0.4						N/A	N/A	N/A
Total	**$195.7**	**$213.0**	**$217.8**	**$231.3**	**$248.0**	**$286.6**	**$304.3**	**4.5%**	**7.4%**

* Data are preliminary and only available for West Virginia University, Marshall University, and West Virginia State University.

Note: N/A indicates that preliminary data were not available for these institutions, whereas blank cell indicate that institutions did not report to the Higher Education R&D Survey in that year.

Source: National Center for Science and Engineering Statistics (2024). Higher Education R&D Survey, multiple years.

FIGURE 21

Federally supported academic R&D drove total R&D growth at West Virginia higher education institutions, along with institutionally supported R&D (e.g., R&D funded by tuition, facilities and administrative costs, fundraising) and all other sources. Industry-sponsored R&D—that is, R&D projects requested and paid for by businesses and performed at academic institutions—declined over the past 10 years, with some growth over the past 5 years.

West Virginia Academic R&D Expenditures ($M) by Source, 2014, 2019–2024, and 10- and 5-Year CAGRs

FIELD	Year							CAGR (%)	
	2014	2019	2020	2021	2022	2023	2024*	10-year	5-year
Federal government	$90.4	$96.6	$95.1	$107.2	$118.7	$137.8	$155.0	5.5%	9.9%
Institutional funds	$65.2	$76.2	$79.8	$82.7	$87.8	$104.4	$97.0	4.1%	4.9%
All other sources	$8.4	$15.8	$17.2	$17.2	$18.4	$19.6	$26.3	12.1%	10.8%
State and local government	$13.8	$11.9	$11.6	$12.6	$13.3	$15.1	$13.4	-0.3%	2.5%
Business/ industry	$12.8	$6.3	$6.6	$4.7	$5.3	$5.5	$6.5	-6.5%	0.9%
Nonprofit organizations	$5.1	$6.2	$7.4	$6.9	$4.5	$4.1	$6.0	1.6%	-0.8%
Total	**$195.7**	**$213.0**	**$217.8**	**$231.3**	**$248.0**	**$286.6**	**$304.3**	**4.5%**	**7.4%**

* Data are preliminary and only available for West Virginia University, Marshall University, and West Virginia State University.

Notes: Federal agencies include U.S. Department of Health and Human Services; National Institutes of Health; U.S. Department of Agriculture; National Science Foundation; Department of Energy. 2019-2023 data include R&D from West Virginia institutions that completed the long-form Higher Education R&D Survey that provides this level of detail including West Virginia University, Marshall University, West Virginia State University, West Virginia School of Osteopathic Medicine, and University of Charleston. 2024 data are preliminary and only available for West Virginia University, Marshall University, and West Virginia State University.

Source: National Center for Science and Engineering Statistics (2024). Higher Education R&D Survey, multiple years.

FIGURE 22

In 2024, the Department of Health and Human Services ($63.4 million), followed by the Department of Energy ($38.1 million) and NSF ($35.9 million), was the top federal funder of academic R&D in West Virginia. In 2024, West Virginia University received the most federal funding.

Federally Supported Academic R&D Expenditures ($M) in West Virginia by Agency, 2019 and 2024

FEDERAL AGENCY	West Virginia University		Marshall University		West Virginia State University	
	2019	2024*	2019	2024*	2019	2024*
HHS (including NIH)	$32.1	$52.4	$6.7	$11.0	$0.2	$0.0
DOE	$14.9	$23.0	$0.0	$0.1	$0.1	$0.0
NSF	$13.4	$17.6	$1.9	$2.3	$0.5	$0.2
Other federal	$5.6	$15.5	$0.7	$2.2	$1.0	$0.1
USDA	$7.2	$11.5		$0.0	$2.8	$3.4
DOD	$3.9	$4.6	$0.2	$5.5		$0.0
NASA	$5.2	$5.4	$0.2	$0.2		
Total	**$82.4**	**$129.9**	**$9.6**	**$21.3**	**$4.6**	**$3.8**

HHS = Department of Health and Human Services; NIH = National Institutes of Health; DOE = Department of Energy; NSF = National Science Foundation; USDA = U.S. Department of Agriculture; DOD = Department of Defense; NASA = National Space Administration

* Data are preliminary and only available for West Virginia University, Marshall University, and West Virginia State University.

Notes: A blank cell indicates an institution did not report data. An amount of $0.0 indicates data are < $40,000.

Source: National Center for Science and Engineering Statistics (2024). Higher Education R&D Survey, multiple years.

FIGURE 23

Life sciences received the most R&D funding in 2024, totaling $178.1 million, followed by engineering ($59.2 million) and non-S&E fields ($20.5 million). Over the past 5 years, most S&E fields experienced growth in R&D expenditures, except for natural resources and conservation (-0.1%), mechanical engineering (-6.6%), and bioengineering and biomedical engineering (-2.4%).

West Virginia Academic R&D Expenditures ($M) and CAGRs by S&E Field, FY 2014, 2019–2024, 10-Year and 5-Year CAGR

FIELD	Year							CAGR (%)	
	2014	2019	2020	2021	2022	2023	2024*	10-year	5- year
Life Sciences	**$114.5**	**$125.6**	**$131.1**	**$150.9**	**$161.5**	**$181.7**	**$178.1**	**4.5%**	**7.2%**
Health sciences	$31.2	$71.6	$70.9	$83.7	$88.8	$97.5	$94.8	11.8%	5.8%
Biological and biomedical sciences	$22.3	$25.2	$30.5	$36.2	$38.7	$49.8	$47.9	7.9%	13.7%
Agricultural sciences	$42.4	$17.4	$17.2	$19.1	$20.7	$21.3	$22.9	-6.0%	5.6%
Natural resources and conservation	$0.0	$10.0	$10.5	$9.6	$11.3	$11.0	$10.0	N/A	-0.1%
Other life sciences	$18.6	$1.3	$1.9	$2.3	$2.1	$2.1	$2.5	-18.1%	13.7%
Engineering	**$41.5**	**$43.7**	**$42.0**	**$42.3**	**$47.3**	**$55.3**	**$59.2**	**3.6%**	**6.3%**
Mechanical	$12.7	$15.6	$11.0	$11.7	$13.7	$7.2	$11.1	-1.3%	-6.6%
Civil	$5.5	$6.4	$5.4	$5.9	$8.0	$10.5	$9.8	5.9%	9.1%
Electrical, electronic, and communications	$8.8	$6.6	$5.9	$3.9	$5.3	$8.8	$9.2	0.4%	6.8%
Chemical	$4.9	$5.1	$5.6	$8.0	$8.6	$8.5	$8.9	6.0%	11.7%
Aerospace, aeronautical, and astronautical		$0.1	$0.1	$0.4	$1.2	$2.7	$7.3	N/A	118.0%
Other	$6.8	$6.1	$6.8	$6.1	$5.8	$5.4	$6.6	-0.3%	1.4%
Industrial and manufacturing		$2.4	$5.1	$4.4	$2.2	$3.9	$3.9	N/A	10.0%

FIELD	Year							CAGR (%)	
	2014	2019	2020	2021	2022	2023	2024*	10-year	5- year
Metallurgical and materials	$2.6	$1.3	$2.0	$2.0	$2.4	$8.2	$2.4	-0.7%	13.1%
Bioengineering and biomedical	$0.1	$0.0	$0.1	$0.0	$0.3	$0.0	$0.0	-5.2%	-2.4%
Non-S&E Fields	**$11.4**	**$10.8**	**$11.3**	**$11.2**	**$10.7**	**$15.6**	**$20.5**	**6.1%**	**13.7%**
Physical Sciences	**$10.7**	**$15.3**	**$14.1**	**$12.7**	**$14.3**	**$17.8**	**$18.7**	**5.7%**	**4.1%**
Physics	$7.1	$8.8	$7.8	$4.9	$5.6	$7.6	$7.9	1.1%	-2.0%
Chemistry	$3.6	$6.5	$6.2	$4.8	$6.4	$6.9	$6.8	6.5%	0.9%
Astronomy and astrophysics				$3.0	$2.3	$3.3	$4.0	N/A	N/A
Geosciences	**$9.3**	**$10.2**	**$9.9**	**$4.4**	**$5.4**	**$5.5**	**$16.9**	**6.1%**	**10.6%**
Geological and earth sciences	$7.3	$7.9	$8.0	$3.3	$4.3	$3.8	$9.0	2.2%	2.7%
Other geosciences	$2.1	$2.3	$1.9	$1.0	$1.1	$1.7	$7.9	14.2%	27.5%
Atmospheric science and meteorology	$0.0							N/A	N/A
Social Sciences	**$4.8**	**$2.4**	**$3.6**	**$3.7**	**$3.2**	**$4.3**	**$3.8**	**-2.2%**	**9.8%**
Computer and Information Sciences	**$0.6**	**$1.2**	**$2.3**	**$2.3**	**$1.8**	**$2.4**	**$2.9**	**17.6%**	**18.4%**
Psychology	**$0.6**	**$2.0**	**$1.8**	**$2.3**	**$1.7**	**$1.9**	**$1.9**	**12.0%**	**-1.6%**
Other Sciences	**$1.8**	**$1.1**	**$1.3**	**$1.1**	**$1.8**	**$1.6**	**$1.8**	**0.2%**	**11.6%**
Mathematics and Statistics	**$0.6**	**$0.7**	**$0.5**	**$0.6**	**$0.4**	**$0.5**	**$0.6**	**0.0%**	**-2.5%**
Total	**$195.7**	**$213.0**	**$217.8**	**$231.3**	**$248.0**	**$286.6**	**$304.3**	**4.5%**	**7.4%**

*2024 data are preliminary and only available for West Virginia University, Marshall University, and West Virginia State University.

Notes: 2019–2023 data are for those West Virginia institutions that completed the long-form Higher Education R&D Survey that provides this level of detail. They include West Virginia University, Marshall University, West Virginia State University, West Virginia School of Osteopathic Medicine, and the University of Charleston. A blank cell indicates data were not available. An amount of $0.0 indicates data are < $40,000.

Source: National Center for Science and Engineering Statistics (2024). Higher Education R&D Survey, multiple years.

FIGURE 24

West Virginia industry-sponsored R&D expenditures in 2024 ($6.5 million) were close to the $6.9 million median for all EPSCoR institutions. Nationally, median industry-sponsored R&D expenditures for all U.S. higher education institutions were $56.0 million. West Virginia's industry-sponsored R&D grew at a slower rate (0.9% per year) since 2019 compared to all EPSCoR institutions (3.1% CAGR) and the U.S. (7.5% CAGR).

CAGR in West Virginia Industry-Sponsored R&D Expenditures Compared to EPSCoR and U.S. Averages, 2014, 2019, 2024, and 10-Year and 5-Year CAGR

LOCATION	Industry-Sponsored R&D Expenditures ($M)			CAGR (%)	
	2014	2019	2024*	10-year	5-year
West Virginia	$12.8	$6.3	$6.5	-6.5%	0.9%
EPSCoR median	$12.7	$6.1	$6.9*	-6.5%*	3.1%*
U.S. median	$37.6	$45.6	$56.0*	5.2%*	7.5%*
Percentage of Total Academic R&D Expenditures					
West Virginia	6.5%	2.9%	2.1%		
EPSCoR median	5.0%	2.1%	1.6%*		

* Indicates that the latest available data were from 2023 for all EPSCoR institutions and all U.S. institutions; 2024 preliminary data were only available for West Virginia. For these regions, 9-year and 4-year CAGRs were calculated.

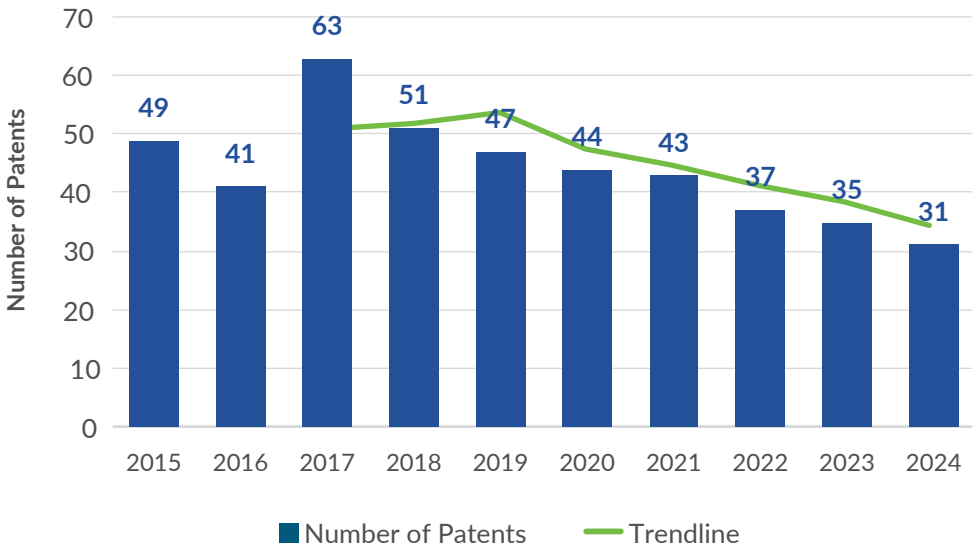
Note: The NSF EPSCoR program supports states and territories that received 0.75% or less of total NSF research funding over the most recent 3-year period.

Innovation and Entrepreneurship

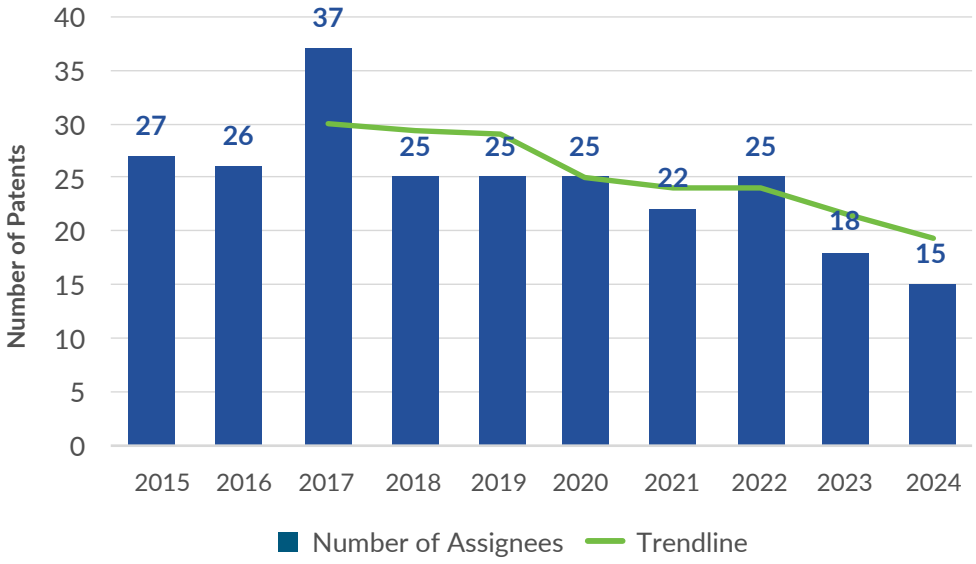
FIGURE 25

Companies, organizations, and individuals seek to patent inventions that may have commercial value. Analyses of 3-year rolling averages of patents granted and unique assignees indicate that both indicators trended down over the past 10 years despite growth in business R&D expenditures (see Figure 18). In 2024, 15 unique assignees were awarded 31 patents, down from 37 unique assignees and 63 patents granted in the peak year of 2017.

Total Number of Patents Granted in West Virginia, 2015–2024



Total Number of Unique Patent Assignees in West Virginia, 2015–2024

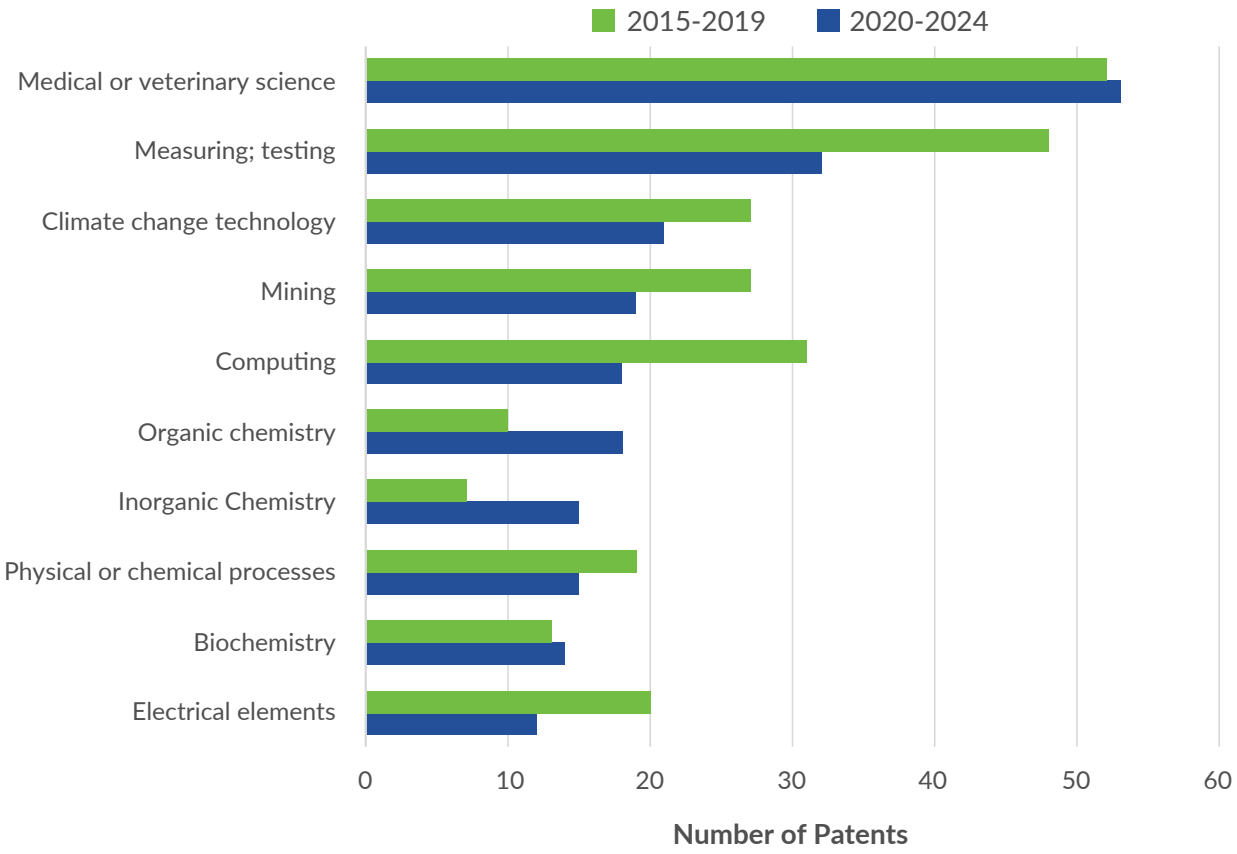


Source: U.S. Patents and Trademark Organization (2024). PatentsView, multiple years. Accessed February 2025.

FIGURE 26

Medical or veterinary science, measuring/testing, and climate change technology were the top patent categories of West Virginia companies, academic institutions, and individuals over the past 5 years. Between the two 5-year periods of 2015–2019 and 2020–2024, patenting decreased in all categories except medical or veterinary science, organic chemistry, inorganic chemistry, and biochemistry.

Top 10 West Virginia Patents Granted by Category, 2015–2019 and 2020–2024



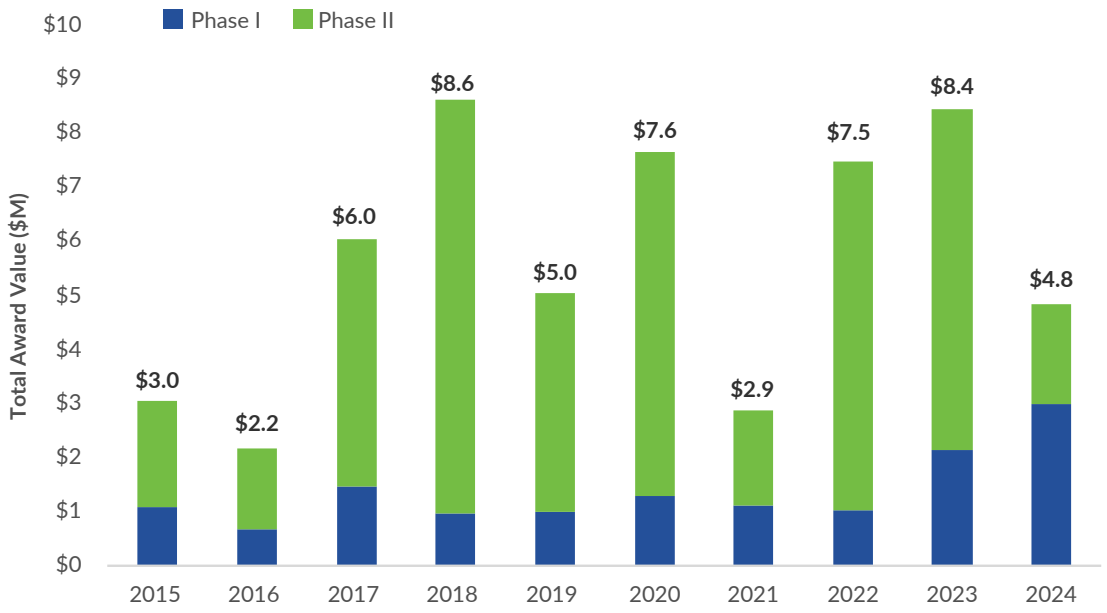
Note: A single patent can be included in more than one cooperative patent classification code. Consequently, the sum of patents awarded by category is greater than the total number of patents awarded.

Source: U.S. Patents and Trademark Organization (2024). PatentsView, multiple years. Accessed February 2025.

FIGURE 27

West Virginia Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) awards decreased from $5.0 million in 2019 to $4.8 million in 2024. The average size of Phase 2 awards was $4.2 million, while the average size of Phase 1 awards was $1.4 million in 2024. The count of Phase 1 awards received has increased from a 3-year average of eight awards in 2018–2020 to 10 in 2022–2024. The count of Phase 2 awards decreased from a 3-year average of five awards in 2018–2020 to three in 2022–2024.

West Virginia SBIR/STTR Total Award Value by Phase, 2014–2024



Source: U.S. SBIR/STTR Award Database. Accessed June 2025.

West Virginia SBIR/STTR Counts by Phase and 3-Year Rolling Averages, 2014–2024

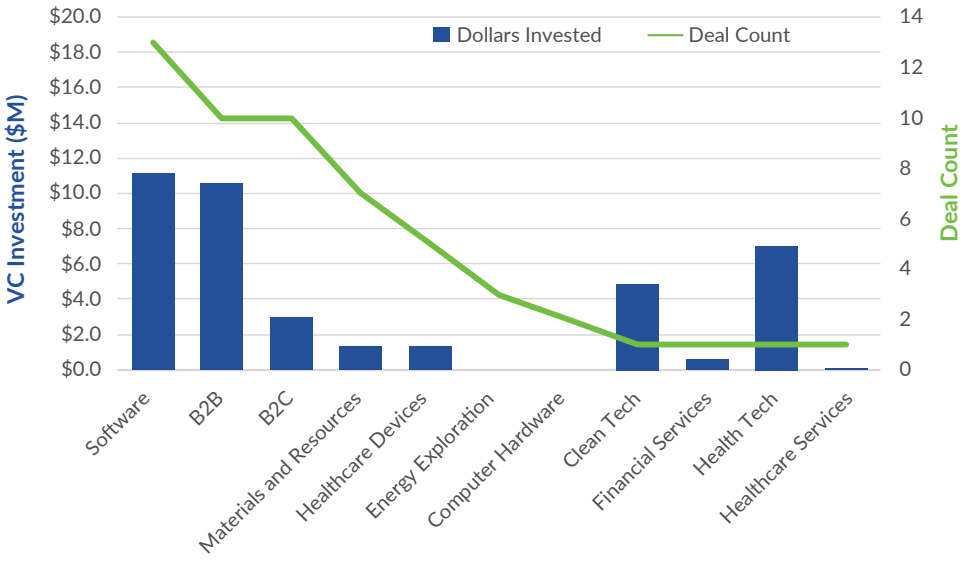
PHASE	Year										3-Year Rolling Averages		
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2018–2020	2020–2022	2022–2024
Phase 1	6	4	9	6	7	10	6	5	11	15	8	7	10
Phase 2	1	1	4	6	4	5	2	4	4	2	5	4	3
Total	7	5	13	12	11	15	8	9	15	17	13	11	14

Source: U.S. SBIR/STTR Award Database. Accessed June 2025.

FIGURE 28

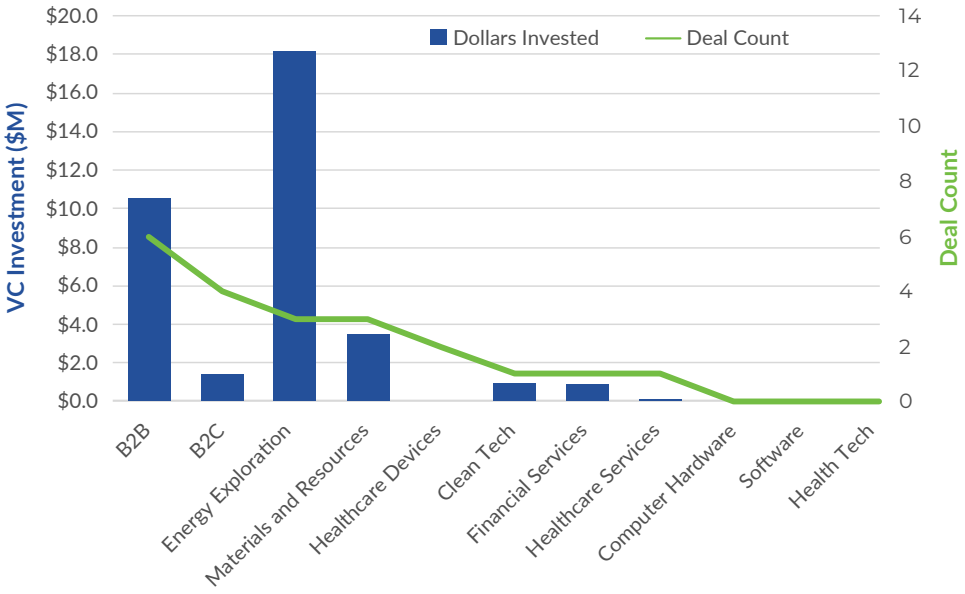
West Virginia venture capital (VC) deals and investment both increased over the past 5 years. Total VC deals grew from $35.4 million invested in 21 deals from 2015 to 2019 to $39.8M invested in 54 deals from 2020 to 2024. Between these two time periods, energy exploration and materials and resources fell from their position in the top three industries receiving the most VC investment.

Count of West Virginia's VC Deals and VC Investment ($M) by Industry, 2020–2024



B2B = Business-to-business; B2C = Business-to-consumer

Count of West Virginia's VC Deals and VC Investment ($M) by Industry, 2015–2019



B2B = Business-to-business; B2C = Business-to-consumer

Source: PitchBook Venture Capital and Private Equity Database. Accessed January 2025.

FIGURE 29

Over the past 5 years, West Virginia companies closed 54 seed and VC deals, with $39.8 million in investments reported to PitchBook. The leading sectors in West Virginia during this period were software, business-to-business services (B2B), and business-to-consumer (B2C) services by deal count. Health tech was third measured by VC investment.

West Virginia VC Deals and VC Investment ($M) by Industry, 2020–2024

PRIMARY INDUSTRY	Deal Count	Investment ($M)	Average ($M)	Minimum ($M)	Maximum ($M)
Software	13	$11.2	$1.6	$0.01	$6.0
B2B	10	$10.6	$2.1	$0.01	$8.0
B2C	10	$3.0	$0.6	$0.02	$1.5
Materials and resources	7	$1.3	$0.7	$0.02	$1.3
Health care devices	5	$1.3	$0.4	$0.1	$1.2
Energy exploration	3	ND	N/A	ND	ND
Computer hardware	2	ND	N/A	ND	ND
Clean tech	1	$4.9	$4.9	$4.9	$4.9
Financial services	1	$0.6	$0.6	$0.6	$0.6
Health tech	1	$7.0	$7.0	$7.0	$7.0
Health care services	1	$0.03	$0.03	$0.03	$0.03
Total	**54**	**$39.8**	**$17.9**	**$12.60**	**$30.5**

Source: PitchBook Venture Capital and Private Equity Database. Accessed January 2025.