2025

THE THIRD COLD WAR: A SOLUTION

QEM NETWORK

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Executive Summary

"Today, the United States is at an inflection point, and it is critical for Congress to make strategic investments and reforms to bolster our S&T enterprise and enhance American competitiveness while leveraging the free market. We must build systems that promote coordination and cooperation across the entire U.S. S&T enterprise and put America first by unleashing our innovation and ingenuity."

-- Per the comments of Rep. Brian Babin (February 5, 2025)

The American Science and Technology (S&T) enterprise is at a significant inflection point, one in which our global competitiveness ranking and national security are declining. Building systems that promote coordination and cooperation to put America first is grounded in domestic talent production and research and development investment in Research-Oriented and Research-Engaged American Colleges and Universities. The current model of Federally Funded Research and Development Centers (FFRDCs) has contributed to S&T growth, but the current model, like most technologies, needs upgrading.

Weaknesses in the current model are its inability to respond to shifting national needs, underutilization of the active FFRDCs in Science and Engineering (S&E) ecosystem through S&T engagement of American Institutions of Higher Education (IHEs), and underutilization in the Skilled Technical Workers (STW) movement and limited use of On-the-Job (OTJ) upskilling efforts for workforce development.

This report provides an overview of the weaknesses with the current FFRDC model, implications for innovative redesign, and recommendations on advancing such a new model, a Joint-Federally Funded Research and Development Center (J-FFRDC) with collaborative research in Advanced Materials, Fusion Energy, Quantum Sciences, and AI Autonomy Trustworthiness dedicated to two national security cornerstones: domestic talent and basic research development.

Introduction

Over the years, Federally Funded Research and Development Centers (FFRDC) have been questioned by Congress (CRS, 2021). With due cause, Congressional concern has been raised regarding FFRDC oversight and management, the mission creep between Centers and private sector, and the limited competition in contracting processes. The origin story of the FFRDC came in response to a national emergency to "mobilize" the country's scientific and engineering talent for U.S. War efforts (CRS, 2021). The country finds itself in another such pressing time.

As defined by the Federal Acquisition Regulation (FAR) systems, FFRDCs "are intended to address an R&D need that cannot be met as effectively by federal government or private sector alone" (CRS, 2021, p.4). Within this context, current characteristics of FFRDCs include being able to:

(1) operate in public interest with objectivity and independence,
(2) be free from organizational conflicts of interest, and
(3) fully disclose their activities to their sponsoring agency. (CRS, 2021)

Current FFRDC operational models have limited contribution to large scale national R&D interests and shifting needs for national security

The five-year renewal method supports long-term relationship building between the FFRDC funding agency and the managing contractor. The founding characteristics of the FFRDC model are valid and grounded in national interest; however, the operational model of the current FFRDCs to contribute to large scale national R&D interests and shifting needs is outdated. Particularly in the face of geopolitical changes, the current FFRDCs are limited in their ability to respond to core national needs in S&E for national security and global competitiveness demands.

Background Context

The GCI 4.0 includes 169 key indicators and 16 closely affiliate with S&E global competitiveness.

Since 1979, the Global Competitiveness Report (GCR) was the annual report published by the World Economic Forum (WEF) that provided a comprehensive overview of the competitiveness landscape of countries worldwide. In 2018, the Global Competitiveness Index (GCI) 4.0, emerged as the core methodology and framework to generate the competitiveness rankings within the Global Competitiveness Report and incorporates new dimensions such as innovation capability, digital readiness, workforce skills, and resilience.

DECLINING GLOBAL COMPETITIVENESS

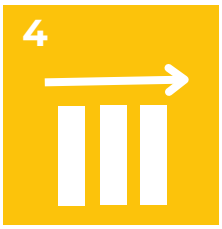
American global competitiveness in S&T is declining. Since 2012 the U.S.'s standing has fluctuated in global competitiveness indicators related to S&T Innovation and R&D.

UNDERPRODUCTION OF S&E DOMESTIC WORKFORCE

Only 2 million of the 14.8 million S&E degree holders between 2018-2020 were American. Both China and India are producing twice as many S&E first degree holding personnel than the U.S.

DECLINING MEASURES OF U.S. WORKFORCE SKILLS

By 2020 the Digital Skillsets, Skillsets of University and High school Graduates, and the Overall Skills of the American workforce declined in global competitiveness.



FLATTENING MEASURES OF INNOVATION ECOSYSTEMS

According to Global Competitiveness Index (GCI) 4.0 data, Growth in Innovative Companies declined as did the measures of University-Industry Collaborations and Commercialization.

Background Context

Global competitiveness is crucial to national security because a nation's ability to innovate, maintain a skilled workforce, and lead in critical technologies directly strengthens its economic resilience, military capabilities, and global influence.

Since 2012, the U.S. has faced fluctuations in global competitiveness rankings tied to science, technology, and innovation, as measured by the World Economic Forum's Global Competitiveness Index (GCI) 4.0. Declines in training availability, higher education quality, and workforce skills have contributed to challenges in maintaining U.S. leadership in these critical areas.

DECLINING GLOBAL COMPETITIVENESS

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Since 2012 the U.S.'s standing has fluctuated in global competitiveness indicators related to S&T Innovation and R&D. The World Economic Forum Global Competitiveness Report turned Global Competitiveness Index (GCI) 4.0 are the premier global competitiveness measures produced by Klaus Schwab, Founder and Executive Chairman of the World Economic Forum. Since 1979, the Global Competitiveness Report (GCR) was the annual report published by the World Economic Forum (WEF) that provided a comprehensive overview of the competitiveness landscape of countries worldwide. In 2018, the Global Competitiveness Index (GCI) 4.0, emerged as the core methodology and framework to generate the competitiveness rankings within the Global Competitiveness Report and incorporates new dimensions such as innovation capability, digital readiness, workforce skills, and resilience.

The Global Competitiveness Report includes 103 indicators of which Innovation, Higher Ed & Training, Quality of Math & Science, Availability of Training and Research, Capacity for Innovation, Government procurement on advance tech, Availability of scientists and engineers, and Quality of scientific research institutions are related to S&E directly. There has been a fluctuating ranking in core areas explicit to S&T. Availability of training and research for improved schools and Higher Education & Training quality both decreased in standing between 2012-2016, and while these measures changed in 2018 the impact was clear as the ranking in Workforce Skills also began to decrease.

Background Context

UNDERPRODUCTION OF S&E DOMESTIC WORKFORCE

Only 2 million of the 14.8 million S&E degree holders between 2018-2020 were American. Both China and India are producing twice as many S&E first degree holding personnel than the U.S.

Between 2018 and 2020, China, India, and America were the largest producers of S&E first degree recipients, totaling 14.8million recipients. However, in alignment with the declining competitiveness of American workforce skills and university-industry collaborations, both India and China out produced U.S. in S&E first degreed persons.

S&E First Degree Production in India, China, and America

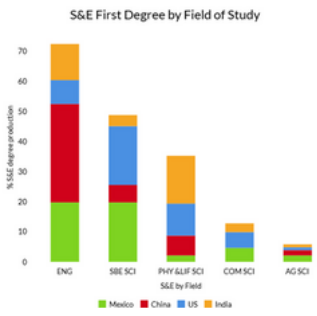
Between 2018-2020, according to National Center for Science and Engineering Statistics (NCSES), Science Indicators

2 out of 14

million S&E first degree recipients were American.

Both China and India are producing twice as many S&E first degree holding personnel than the U.S. Within those S&E first degree holding persons, China is outproducing American Engineer production by nearly 4x.

In 2020, only 7.9% of the S&E first degree recipients in the U.S. were Engineers, yet 32.8% of the S&E first degree recipients in China were Engineers. Additionally, even Mexico is producing a proportionally larger percentage of Engineers than the U.S., likely in response to increase presence of American manufacturing and automotive industries in Mexico. While FFRDC R&D Obligation investment has increased nearly 100% since 1967, the U.S. standing in key global S&T competitiveness measures is declining. The skills of the national workforce are declining, commercialization is declining, the U.S. is producing less S&E first degreed persons at the collegiate level, and university-industry collaboration is declining



According NCSES available data, China and Mexico had higher percentages of S&E first degree awards in Engineering than United States in 2020.

Background Context

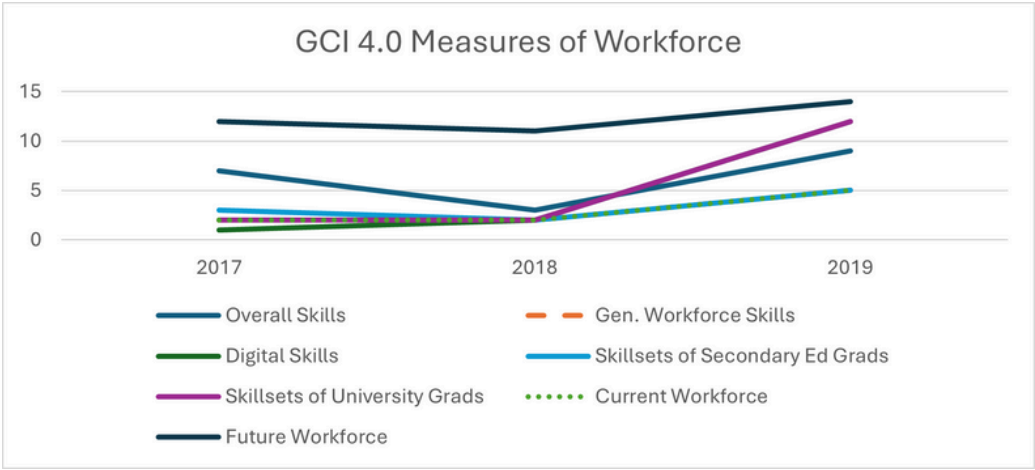
Falling rankings in GCI 4.0 workforce measures suggest declining trust in the ability of the American worker.

Seven specific measures assess quality of workforce for global competitiveness: Digital Skills, General Workforce Skills, Overall Skills, Skillsets of University Graduates, Skillsets of Secondary Education (High School) Graduates, Current Workforce, and Future Workforce. Each is critical to the S&E national ecosystem in an increasingly digital and technological society.

DECLINING MEASURES OF U.S. WORKFORCE SKILLS

By 2020 the digital skill sets, skill sets of university and high school graduates, and the overall skills of the American workforce declined in global competitiveness.

Where the U.S. once ranked Top 3 in skillsets of Secondary Education graduates, suggesting some of the most rigorous Secondary School training in the world, we have lost this ranking (5th as of 2019, pre-pandemic). Measures for University Grads is more disappointing, where the 2017 rankings had the U.S. in 3rd, 2019 rankings place the Skillsets of University Graduates at 13th globally. Our ranking in Overall Skills has fallen to 9th globally as of 2019. Given the Global Competitiveness Report indicated "Availability of Training and Research for Improved Schools" and "Higher Education & Training Quality" both decreased in standing between 2012-2016, it is clear there has been an impact on the rankings of Workforce Skills began to decline in 2018. Less rigorous teaching likely resulted in less skilled graduates and workforce.



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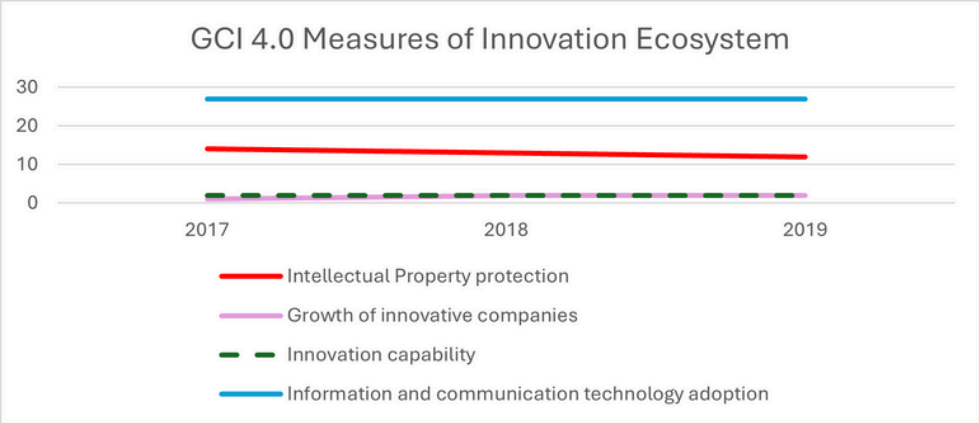
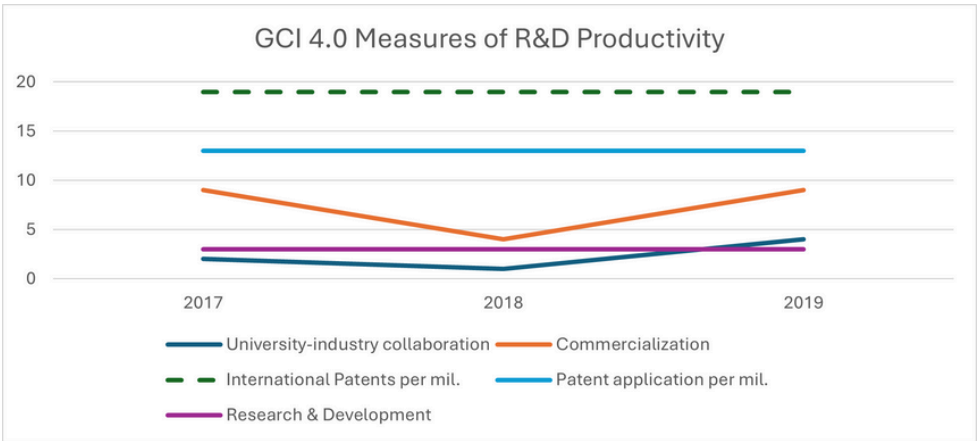
FLATTENING MEASURES OF INNOVATION ECOSYSTEMS

According to Global Competitiveness Index (GCI) 4.0 data, Growth in Innovative Companies declined as did the measures of University-Industry Collaborations and Commercialization.



Slow to no growth in American Innovation in technology, commercialization, and ownership of intellectual property creates overarching economic issues that threaten national security in a fundamental way. While the U.S. has flatlined in the top 5 globally for innovative company growth, it ranks 9th in Intellectual Property protections, suggesting a weakness in being able to protect American Innovation from global competitors.

In a global economy dependent on information and communication technologies (ICTs), the U.S. fails to rank top 25 in their ability to use or leverage ICTs which serves as a hindrance on economic competitiveness (Sharma, 2021). Flatlined rankings in Research & Development and falling rankings in University-Industry Collaborations suggest intersectional influence on Commercialization as well. Less collaboration is less access to resources.



Problem Statement:

Declining Competitiveness threatens National Security.

To have not only numerically less, but also less skilled workers in a less collaborative ecosystem is a problem for national security. As U.S. ranking in global competitiveness in key areas falls, our ability to leverage internal resources and negotiate with those resources also declines, forcing our country to become more dependent on external resource use. Given the national context, there are two significant problems that emerge from the current FFRDC national model.

Key Problem	Data	Recommendation
Underutilization of FFRDC in Academic Research Ecosystem Advancement	Institutions of Higher Education (IHEs) represent 24% of the federal obligations in R&D FFRDCs represent about 10% (CSR, 2021)	Develop J-FFRDC exclusively for IHEs
Underutilization of FFRDC in S&E Workforce Development	2023 IPEDS data demonstrated IHEs with the highest amounts of federal R&D and programmatic obligations ($116bn) only graduated 26.8% of the total S&E degrees and only 23.7% of the domestic talent S&E degrees, while the **IHEs with less R&D federal obligations graduated 76.3%** of all S&E domestic talent in the U.S.	Create J-FFRDC with S&E talent production core component

Problem Statement

Underutilization of FFRDC in Academic Research Ecosystem Advancement

The IHE-research ecosystem is the ecological framework that emerges from U.S. colleges and universities initiating basic, applied, experimental or clinical research and redevelopment (R&D) concepts. Institutions of Higher Education (IHEs) or colleges and universities represent about 24% of the federal obligations in R&D, while FFRDCs represent about 10% (CSR, 2021), but IHEs award 100% of the undergraduate and graduate degrees in the S&E fields critical for national S&E industries. Advancing IHE-research ecosystems is vital for two reasons: (1) increased R&D expenditures correlate to increase student retention and graduation rates (Lynch, Towns, & Allen, 2021), and (2) increased federal research obligations correlate to research facilities growth and improvements.

In FY2023, the top 100 of the 146 Very High Research Active (R1) universities received approximately 45% of the R&D and programmatic federal funding obligations. These 100 IHEs also reported being responsible for 81% of the total FY2023 R&D expenditures. These institutions represent only 3% of the 3,294 public and private not-for-profit colleges and universities in America. They reportedly produced only 31% of the American S&E (NCSES, 2025) degrees in FY2023.

Additionally, according to NCSES reporting, the average square footage of research facilities for those Colleges and Universities with the highest expenditures is 1,519 per institutions (an average of 151,894ft^2 for 100 IHEs), but for those with the least expenditures the average square footage of research space is 102 (45,045ft2 for 440 IHEs). Reported capitalized equipment expenditures for the doctoral universities (inclusive of the 100 highest R&D spenders) has grown 35% over the last decade. In FY2023 those expenditures grew 17% alone, suggesting an increased availability of capital equipment and resources. However, for all non-doctoral colleges and universities (which includes all non-R1 institutions) they have seen a **66% decrease in capitalized expenditures,** with only a 1.4% increase in the purchase of capitalized equipment in FY2023.

The long-term, year over year investment in capitalized equipment and software means certain American Universities have been able to grow their capital assets to engage in more research activities.

Problem Statement

Underutilization of FFRDC in S&E Workforce Development

100% of American S&E first degree recipients are produced at and by U.S. colleges and universities, as FFRDCs are currently incapable of credentialling S&E personnel. In 2023 IPEDS data demonstrated that the institutions with the highest amounts of federal R&D and programmatic obligations ($116bn) only graduated 26.8% of the total S&E degrees and only 23.7% of the domestic talent S&E degrees, while the institutions with less R&D federal obligations graduate 76.3% of all S&E domestic talent in the U.S. Despite the relationship between R&D expenditures and student success, the schools with less funding numerically graduate more students, and could graduate more with increased investment in these efforts. The solution would be to increase the R&D federal obligations directly to the institutions not already in the top 100, but to do so would require investment in the research resources and infrastructures of non-R1 institutions.

As reported in the NASEM (2024) DoD Investment report there is a phased approach necessary for less-resources schools with the most enrolled domestic talent. The first phase is to provide infrastructure funding that allows Facilities and Equipment upgrades in response to under-resourcing. Then the second phase is to acquire enough external funding to engage in basic research that yields resources for increased personnel, and the third phase is to scale research activities into applied or translational fields for commercialization that would produce sustainable funding resources for the research ecosystem. At minimum a 10-year (Lynch, 2022). U.S. global competitiveness and national security issues cannot wait 10-years for schools to engage more rigorously in the R&D ecosystem.

Akin to the Department of Defense S&E training model with accelerated and on-the-job (OTJ) technical training work for airmen, soldiers, and seamen, a remodeled FFRDC OTP training program can prepare a localized domestic talent workforce in partnership with R&D underfunded, undergraduate institutions. Such partnerships cannot only grow the immediately available S&E workforce but also increase the skills of such a workforce. In leveraging the FFRDC as an STW training facility with OTJ site for explicit S&E workforce development there are both immediate and long-term impacts.

In summary, three percent of the American colleges and Universities receive 45% of the R&D federal obligations, expend 81% of the R&D funding, have benefited with 35% growth in capital assets and equipment, but only produce 23% of the American S&E first degreed graduates in this country. They receive a lion share of the funding to produce less than a quarter of the S&E workforce.

Analysis

Need for multi-agency funding

According to the CSR (2021) report, 14 agencies currently support FFRDCs. Department of Energy allocates 65.1% of its R&D budget to 16 FFRDCs. National Aeronautics and Space Administration (NASA) allocates 15.5% of its R&D budget to one FFRDC. Nuclear Regulatory Commission (NRC) allocates 37.4% of its R&D budget to one FFRDC. National Science Foundation (NSF) supports three FFRDCs utilizing 5.1% of its annual R&D budget. By disbursing the FFRDC contributions from multiple federal agencies, there is a sustainability element that becomes administration proof that even in the face of agency budget fluctuations between changing executive administration priorities, the national security interest of the new FFRDC stays protected.

Need for coordinated mission specific basic research agenda

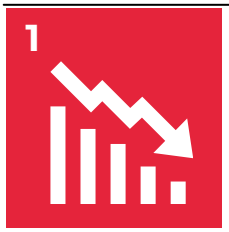
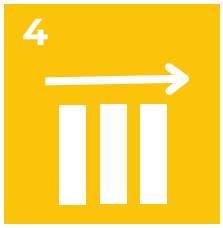
Despite the extreme focus on applied and translational science at the current FFRDCs, there is still a major need for basic research in Advanced Materials, Fusion Energy, Quantum Sciences, and AI Autonomy Trustworthiness. There is also a strong relationship between these fields which if a shared basic research agenda could be established and supported with collaborative efforts of researchers from institutions across the country within this singular facility then there would be a larger impact. The agencies of DoD, NASA, DOE, and NSF each have mission specific elements aligned with basic research support.

Need for technical assistance national laboratory framework with a specialized on-the-job training.

There would be a lower cost to IHEs by engaging in S&E research through this J-FFRDC and higher return of high-quality basic research findings. Research conducted in a J-FFRDC would allow IHEs to take the results and data back to their own campuses for development of other competitive applications to varied funding sources. It would decrease the time necessary for them to upgrade physical facilities to conduct this work and thus acquire funding that provides more direct resources to their S&E workforce efforts. Secondarily, the OTJ training model will upskill the S&E skillsets of the surrounding community members in the selected locale of the new J-FFRDC. This would provide almost immediate economic impact through job placement at the J-FFRDC with technicians trained to operate the equipment for the visiting IHE researchers. The TA framework and OTJ training components will contribute directly to global competitiveness measures.

Call to Action

The Third Cold War is here. American global standing in S&T is faltering. The need for a new model of national investment in the R&D ecosystem is required as the Science and Technology Council has identified (Feb.5 2025). Evidence supports the manner in which India, China, and Mexico are both numerically and proportionally outproducing the U.S. in S&E workforce production. Evidence supports the current model of R&D investment practices result in 45% of R&D and programmatic federal obligations being awarded to the 100 colleges and universities which only contribute to 23% of the S&E workforce.

Issue	Evidence	Impact	Recommendation
	GCI 4.0 reported decline in Global Competitiveness rankings	Decreases U.S. economic strength	Innovate R&D ecosystem engagement model
	S&E workforce and talent underproduction of most resourced IHEs	Decreases availability of highly skilled S&E workforce for U.S.	Emphasize S&E domestic talent production through reinvestment in STW program
	GCI 4.0 reported decline in U.S. workforce skills development and acquisition	Less skilled workforce for ICT reliant, S&E industries critical to U.S. security increases vulnerability	Emphasize OTJ opportunities in new FFRDC model
	GCI 4.0 reported plateaued innovation measures for U.S. innovation ecosystem	Increases U.S. reliability on external innovations and national security risks	Develop new FFRDC model for increased IHE scientific innovation engagement in national security basic research areas

QEM NETWORK

Our Mission

QEM Network serves as a national resource and catalyst to unite and strengthen educational opportunities for all American citizens in science, technology, engineering, and mathematics (STEM) fields by advancing quality education, domestic talent, and leadership.

Our Points of Pride

- 34 years of relationships with Research-Oriented and Research-Engaged American Colleges and Universities. We have served over 1,500 organizations through our programming.
- Extensive experience with multi-agency contracting and funding management to support R&D activities for the country.
- Providing technical assistance for R&D development training to over 15,000 individuals in the United States and helping researchers attain nearly $1.7 billion in R&D funding.
- 30 years experience with internship program facilitation to support workforce development in S&E industries.

Our Vision

QEM Network seeks to work with individuals, organizations, and institutions across the country to coordinate and energize efforts to improve the education of domestic talent in science, technology, engineering, and mathematics (STEM) fields. We are dedicated to advancing domestic talent participation in STEM disciplines throughout the nation through capacity building, student professional development, faculty development and research.

Contact

QEM Network
1818 N Street NW., STE 350
Washington, D.C. 20036, USA
202-659-1818

www.qem.org
qemnetwork@qem.org
LinkedIn: @qemnetwork

References

Anderson G and Pece CV. (2023). National Center for Science and Engineering Statistics (NCSES). Per-Student Federal Obligations for R&D and Fellowship, Training, and Traineeship Grants at HBCUs and Other Minority-Serving Institutions. NSF 23-325. Alexandria, VA: National Science Foundation. Available at https://ncses.nsf.gov/pubs/nsf23325/.

Congressional Research Service. (2021, August). Federally Funded Research and Development Centers (FFRDCs): Background and Issues for Congress. [R44629]. https://crsreports.congress.gov/product/pdf/R/R44629/8

INSEAD (2023): The Global Talent Competitiveness Index 2023: What a Difference Ten Years Make What to Expect for the Next Decade. Lanvin, B. and F. Monterio (Eds). Fontainebleau, France. https://www.insead.edu/system/files/2023-11/gtci-2023-report.pdf

Lynch, E. (2022). Why Ramping up Research at HBCU's is Critical for Improved Academic Innovation and Scholarship [Chap. 12]. In Smith-Ross, C. (Eds). Effects of the Covid-19 Pandemic on HBCU's Academic and Social Culture, Lewiston, New York: Mellen Press.

National Academies of Sciences, Engineering, and Medicine. 2022. Defense Research Capacity at Historically Black Colleges and Universities and Other Minority Institutions: Transitioning from Good Intentions to Measurable Outcomes. Washington, DC: The National Academies Press. https://doi.org/10.17226/26399

National Science Board, National Science Foundation. 2019. Higher Education in Science and Engineering. Science and Engineering Indicators 2020. NSB-2019-7. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20197/

National Science Board. (2020, May). Vision 2030: Vision for the Future. https://nsf-gov-resources.nsf.gov/nsb/publications/2020/nsb202015.pdf

National Science Board, National Science Foundation. 2023. Higher Education in Science and Engineering. Science and Engineering Indicators 2024. NSB-2023-32. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb202332/

National Center for Science and Engineering Statistics (NCSES). 2024. FFRDC Research and Development Expenditures: Fiscal Year 2023. NSF 24-328. Alexandria, VA: U.S. National Science Foundation. Available at https://ncses.nsf.gov/surveys/ffrdc-research-development/2023.

Qazi, A. (2023). Exploring Global Competitiveness Index 4.0 through the lens of country risk, Technological Forecasting and Social Change, 196, ISSN 0040-1625, https://doi.org/10.1016/j.techfore.2023.122856.

Sharma, D. (2021). The Impact of Information and Communication Technologies on Economic Competitiveness. Munich Personal RePEc Archive. Online at https://mpra.ub.uni-muenchen.de/116470/ MPRA Paper No. 116470, posted 22 Feb 2023

World Economic Forum (2015), The Global Competitiveness Report 2014-2015.

World Economic Forum (2016), The Global Competitiveness Report 2015-2016.

World Economic Forum (2017), The Global Competitiveness Report 2017-2018.