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Before the:

**U.S. Senate Committee on Commerce, Science, and Transportation**
**Subcommittee on Science, Technology and Manufacturing**

Hearing on:

# "Measuring What Matters: Science, Standards, and Strategic Competition"

July 21, 2026
SR-253 Russell Senate Building
Washington, DC

## CONTENTS

## INTRODUCTION AND SUMMARY

Chairman Budd, Ranking Member Baldwin, and members of the Committee, I am Robert Atkinson. As the founder, former president, and now a senior fellow of the Information Technology and Innovation Foundation (ITIF)—and previously as a project director at the former Congressional Office of Technology Assessment—I have focused on science, technology. and U.S. competitiveness for more than 35 years.

I commend the Committee for your important efforts to assess how well the current U.S. scientific and engineering research system fits the new environment of robust technological and industrial competition with China.

## THE NEED FOR CHANGE

Policy usually changes incrementally, as Congress assesses current performance and makes needed adjustments. But at various times in the history of our Republic, policy has changed in more fundamental ways. When it comes to the U.S. science, engineering, and technology research system ("the research system"), now is the time for such a fundamental change. We need to abandon the dominant paradigm of investigator-led basic research that has been in place since MIT President Vannevar Bush crafted it after World War II. That model worked when the United States was dominant in science and technology. It no longer works in a world where there is much more parity—and, in particular, when we have an aggressive and capable competitor in the form of the People's Republic of China (PRC). The status quo no longer suffices. It is time for a new model.

## WHY TECHNOLOGY PRODUCTION MATTERS

Before discussing the need for change and the changes needed, it's useful to put the issue in context. A key source of national wealth and power comes is the technological sophistication of a country's production system. Lagging nations principally produce handcrafts or low-skill assembly products. Many middle-income nations have graduated to slightly more complex manufacturing (e.g., steel and machine production). But the leading edge of technological power now comes from incredibly complex and challenging technologies. Technologies that are extremely difficult to develop and produce at scale.

Take two examples. The first is semiconductor lithography machines, or machines that make semiconductors. A core component in the machines are mirrors made mostly by German firm Carl Zeiss SMT. These mirrors are so precise and smooth that the acceptable surface deviation is 50 picometers (50 trillionths of a meter), which is less than the width of a strand of spider silk. To put that into perspective, a 50-picometer deviation on a mirror that is 450 millimeters wide would be just 0.4 micrometers (0.0004 millimeters) if you were to scale that mirror up to the size of the United States.[1] Second, consider biotechnology, the production of living cells for some purpose, such as curing disease. A single batch of a biotech drug requires up to 13,000 individual process steps and quality-control checks, and the level of allowable imperfections per dose is the equivalent of locating one grain of sand hidden inside an Olympic-sized swimming pool.

While not all advanced technology industries require these levels of sophistication, they all require complex knowledge. As science fiction writer Arthur C. Clarke wrote: "Any sufficiently advanced technology is indistinguishable from magic."[2] Indeed. Just look at your cell phone. It seems like magic.

These kinds of advanced-technology industries depend on many factors for a nation to be globally competitive in them. One, as I will discuss below, is a strong foundation of scientific, technical, and engineering knowledge.

A second factor is the ability to compete on a level global playing field. Advanced technology industries are characterized by high fixed costs compared with marginal costs. That means they must incur very high upfront expenses before they can even produce the first chip, drug dose, or jet airplane. Economists describe such industries as experiencing increasing returns to scale, meaning that each additional unit sold yields a higher rate of profit because average costs decline.

In these industries, survival depends on innovation and scale. And scale, by providing robust revenues, enables further innovation. As such, being able to sell to global markets is critical. Otherwise, costs won't fall, and R&D won't increase. And competitors will gain structural advantages that ultimately can lead to the demise of U.S. firms. Conversely, U.S. sales of advanced goods and services often take market share from Chinese competitors, limiting China's capacity to reinvest and expand. As an example, if sales of China's COMAC jet airplane were limited in the West, then Boeing would have adequate funds to reinvest in the next generation of passenger jets, and COMAC, even with its massive government subsidies, would be slowed down.

## THE CHINA CHALLENGE

A strong knowledge base and robust global sales is critical for continued U.S. techno-economic power. It would be one thing if U.S. competitors were NATO members and other close allies. While it would not be good for America, it would not be the end of the world if South Korea took over semiconductors or Airbus took over commercial jets. This is particularly true because these allied, democratic, market-based nations generally do not want to crush the rest of the competition, and for the most part they play by the rules. This means there would still be space for American advanced technology exports.

But China changes everything. First and foremost, as long as it is governed by an avowed Marxist-Leninist party, China will be an adversary intent on dominating advanced industries globally.[3] And unlike the Soviet Union's Gosplan-directed economy, China has embraced just enough capitalism to achieve its aggressive goals.

What are its goals? Perhaps the best analysis comes from Daniel Tobin, Professor of Practice at the U.S. National Intelligence University. In a May 7, 2025, article titled, "The Persistent, Soaring Ambitions of Xi Jinping's 'New Era' for China, Socialism, and the Globe," Tobin analyzed party documents, including Xi Jinping speeches and statements.[4]

He quotes Chinese Leader Xi Jin Ping:

> Since 1992, the CCP's constitution has maintained that: "The general starting point and criteria for judging each item of the Party's work are that it must benefit the development of the socialist productive forces, be conducive to increasing socialist China's comprehensive national power, and help to improve the people's living standards."

The consensus view in Washington is that China just wants to be strong and prosperous, just as any large developing country wants to be. But Tobin disagrees:

> Indeed, while some external observers have rushed to point out that the official translation says a global leader not the global leader, it strains credibility that, already seeing itself as the number two power in the world as measured in computations of comprehensive national power, Beijing's goal could be to work hard for several decades only to remain number two. In specific areas of international competition including economics, science and technology, innovation, and military capabilities, Xi repeatedly talks about "seizing the initiative," and for and the need for China not to miss another historical opportunity to assume leadership. Indeed, a 2021 People's Daily editorial under the pseudonym "Manifesto" (宣言), which Beijing has used several times to express the ambitions of the new era, maintains that "Gaining the upper hand in the competition of comprehensive national power is the key to national rejuvenation."[5]

Tobin goes on to argue:

> Xi Jinping, from his first days in office, has continued to underline these arguments for remaining committed to socialism; yet he also returned to the arguments about socialism's inevitable international triumph that had not been emphasized since the Mao era.[6]

What is troubling is that most U.S. foreign policy experts don't seem to take Xi seriously, assuming that he is simply mouthing Marxist-Leninist platitudes for the party faithful. This may be in part because they believe that only countries like North Korea and the former Soviet Union are really Marxists. For them, "socialism with Chinese characteristics" is a slogan the CCP proselytizes to pacify the core party members.

However, as former UK diplomat Charles Barton writes:

> Internally, when promulgating to its members the speeches of Xi Jinping…party documents and instructions, the CCP speaks of an ideological struggle between systems in which the People's Republic of China will gain domination over the United States. Externally, its foreign propaganda system derides the notion of a new cold war, and speaks of 'win-win' or 'a community with a shared future for mankind.[7]

Finally, as Xi has stated: "Technological innovation has become the main battleground of the global playing field, and competition for tech dominance will grow unprecedentedly fierce."[8]

## CHINA'S INNOVATION SUCCESS

Measuring a nation's innovation success is difficult, largely because there are few valid and internationally comparable measures of actual innovation. However, three types of measures are used: inputs to the innovation process; outputs from the inputs; and outcomes. On many, science and innovation metrics, if not most, China now leads the United States.

### Inputs

The principal input measures are R&D spending and production of STEM talent.

- China's expenditures on R&D, (PPP prices), was $1.03 trillion in 2024 compared to the United States' $1.01 trillion.[9]

- China's business enterprise expenditure on R&D (PPP current prices), was $799 billion compared to the United States' $782 billion.[10]
- China has 3 million full-time equivalent researchers in 2023 compared to the United States' 1.7 million.[11]
- When looking at the top 2,500 businesses in terms of R&D spending and controlling for researcher costs, U.S. firms invested just 13 percent more than Chinese firms in 2024. However, when excluding biopharmaceuticals and software, where the United States is the strongest, Chinese firms invested 6 percent more than U.S. firms, with China investing at least 75 percent more than U.S. businesses in industrial engineering, electronic and electrical equipment, and alternative energy.[12]

### Outputs

The principal output measures are publication counts, patent filings, clinical trials listed, and quality of research institutions.

- Articles published in high-quality natural-science and health-science journals: China had 58,532 articles compared to the United States' 36,860 from March 2025 to February 2026.[13]
- Chinese AI publications accounted for 20.6 percent of all AI citations in 2024, with the United States at 12.6 percent.[14]
- In 2024, China accounted for 17.8 percent of AI publications globally while the United States accounted for just 7.3 percent.[15]
- From 2014 to 2025, China's share of highly cited researchers globally rose from 4 percent to 20 percent. The U.S. share declined from 53 percent to 37 percent.[16]
- For the number of highly citated AI publications in the top 100 journals, the United States scored 46 and China 41.[17]
- In 2025, there was 3.9 times more venture capital investment in China than the U.S. (in PPP terms) and 1.9 times more in dollars.[18]
- According to the Australian Strategic Policy Institute, "China is no longer merely leading the research in major technology fields. It's also moving towards a monopolistic position in most of them."[19]
- According the *2026 Nature Index* of the top 25 research universities globally, 21 are Chinese and just three are American. And when scored according to rank (the top university receives a score of 25 and the 25th receives a score of 1), China scores almost six times more than the United States (275 to 47).[20]
- China listed 7,100 clinical trials in 2024, with 6,000 for the United States. Additionally, 37 percent of the licensed molecules produced this year are projected to come from China.[21]
- As of 2022, China produced over 35 percent of the publications in top-tier journals, up from nearly zero in 1980. The United States' share fell from 60 percent to 25 percent. Chinese researchers lead the world in engineering, physical sciences, and materials engineering, but have not yet overtaken the United States in fields such as biomedical and health sciences.[22]

- The Nature Index of publications in leading journals finds that China has 59 percent more than the United States.[23]
- For patents filed under the international patent cooperation treaty (PCT), China filed 73,718 applications in 2025 vs. 52,617 for the United States.[24]

### Outcomes

The principal outcome measures include growth of real output in advanced technology industries, technology exports, and productivity growth.

- China holds nearly one-quarter of the global market across 10 advanced industries, and is leading production in 7 of the 10. To match China's advanced industry value-added output as a share of GDP, U.S. advanced-industry output would have to grow by $1.5 trillion.[25]
- China dominates the electric vehicle industry, the steel industry, solar panels, batteries, telecom equipment, chemicals, rare earths, high-speed rail and more. Leading American firms like GE Appliances, IBM's PC business, Lexmark, Motorola Mobility, Magnequench, Cirrus Aircraft and Teledyne Continental Motors, Omni Vision Technologies, and A123 have all been bought by Chinese companies.
- In other cases, U.S. firms such as First Solar, Lucent, Molycorp (rare earths), and 3D Robotics have lost significant market share or exited the market because of unfair Chinese competition.
- China's targets going forward are even more extensive, in consumer electronics, semiconductors, fine chemicals, machine tools and robotics, AI, biotechnology and quantum computing. And the risk to leading industries in each of 50 states is often significant.[26]
- Of 10 advanced industries, China was ahead of or on par with the United States in innovation on two (nuclear power and EVs and batteries), near the United States on four (robotics, quantum computing, AI and displays) and lagging on four (semiconductors, chemicals, biotech, and machine tools) but making rapid progress on three of these. Another data point: the United States runs an annual trade deficit in advanced technology products with China of $93 billion.[27]
- According to the U.S. Census, the United States in 2024 ran a $69 billion trade deficit with China in advanced technology products.[28]

## THE CURRENT U.S. RESEARCH SYSTEM

U.S. science policy has gone through a number of relatively distinct stages. After WWII, when science came to be seen as critical to winning the Cold War and addressing a host of other national challenges, a bipartisan consensus emerged that the federal government needed to expand its funding of science. But it was not clear what the model should be. On one side was Senator Harley Kilgore (D-WV), who wanted a federal science agency to advance explicit national goals and purposes. On the other side was scientist Vannevar Bush, who, in his 1945 report to the president, *Science: The Endless Frontier*, advocated for a scientist-led model with individual scientists free to pursue their own interests.[29] With the establishment of the National Science Foundation (NSF) in 1950, Bush's vision prevailed. Bush articulated a linear model of innovation, wherein the federal government funded basic research and then, through some unexplained process, came commercial innovations. Even though that model has been thoroughly debunked in the science policy literature, it remains the guiding standard for U.S. research policy.[30]

Bush envisioned five key aspects of this system:

1. **There must be significant federal funding.** By the early 1960s, federal support for research had reached 2 percent of GDP.

2. **Funding should be merit-based,** going to the best universities and researchers, with no focus on geographic diversity.

3. **There should be no strings.** As Bush wrote, "Scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown."[31]

4. **All disciplines are equal.** If science is to be investigator-led, then government should not favor some disciplines over others. The primary goal is knowledge generation. And all fields are equally capable of producing knowledge. Astronomy is as valuable as computer science.

5. **Science should be global.** Bush wrote that "the Government should take an active role in promoting the international flow of scientific information."[32] The advancement of science benefits humanity, so international collaboration is valued even if the United States is a net exporter of scientific knowledge.

The United States could afford this model because we dominated both scientific research and manufacturing. It wasn't even close. And so, the current science system was established and remains embedded, even as the United States lags dramatically behind world leaders in manufacturing, especially China, and it is struggling to keep pace with China in science.

While science was to be "pure," there was also a realization that science and engineering played key roles in supporting key national missions. Indeed, the dictates of the Cold War meant that certain disciplines, especially physics, engineering, and later computer science, were privileged. This included defense, space, health, agriculture, and energy. These were seen as acceptable areas for government support for not just early stage research but also later-stage development because they were areas the private sector would underinvest in. But unlike most U.S. competitors, including China, national competitiveness was never a mission. That was up to the private sector alone.

The United States has never before faced a techno-economic challenge like it does now with China. The Soviets were a military adversary, but not a techno-economic adversary. China is both. As such, it is time to reconceive and significantly reform the U.S. research system.

## IMPLICATIONS FOR FEDERAL POLICY

These changes in the global environment suggest a number of changes are needed in federal research policy.

### More Funding

While the focus of this hearing is on measurement and accountability, it is worth noting that federal support for R&D has fallen as a share of GDP. It was 1.86 percent of GDP during the height of the Cold War and has fallen to around 0.62 percent. With funding scarce, one option is to tie any new increases specifically to applied R&D in what ITIF calls "national economic power industries."[33]

Some argue that we don't need more federal investment in research because the private sector will simply fill in the gap. But scholarly research has disproved that idea. Federal funding of science is not a substitute for private sector research; it is a complement.[34] After reviewing over 60 academic articles on whether public sector R&D crowds out private-sector investments, Cockburn and Henderson concluded:

> There are a number of econometric studies that, while imperfect and undoubtedly subject to improvement and revision, between them make a quite convincing case for a high rate of return to public science in this [life-sciences] industry. It is worth noting that there are, so far as we are aware, no systematic quantitative studies that have found a negative impact of public science.[35]

## Shift Funding More Toward Applied Research

One way to differentiate between policies and programs is on the basis of what economists call spatial externalities. In other words, domestic policies can have effects beyond the border, either helping or hurting other nations. Some activities, such as basic research, spill over and help other nations. Scholarly research shows that when a country, even one as large as the United States, funds basic research, the majority of the benefits "spill over" to other nations, and they can use that knowledge to help their own economies.[36] In contrast, a larger share of the benefits of applied R&D are retained in the country.

Given this, the rational thing for any country wishing to maximize its welfare is to invest more in applied research while relying on others for basic research results. That is what most countries other than the United States do. They essentially free ride 'on U.S. investment in basic research.

Related to this, other countries target economic competitiveness much more in their R&D funding. According to an OECD study, the United States ranks 34th in out of 36 nations in the share of total federal R&D invested in industrial production and technology.[37]

For too long, the United States has been doing the responsible thing, and other nations have been doing the "selfish" thing. The United States has long invested significant funds into basic research through agencies like NSF, the National Institutes of Health (NIH), and the Department of Energy (DOE). In contrast, nations like China, France, Germany, Japan, South Korea, and Taiwan devote a significantly larger share of their R&D budgets to applied research to benefit their domestic industries.[38]

For example, most of China's research is later-stage research designed to give its firms advantage. China knows that it can free ride off U.S.-funded basic research. Chinese researchers attend international conferences to hear U.S. researchers present their findings. They subscribe to all the scientific journals that publish results of NSF recipients' work. They send their graduate students and post docs to U.S. universities.[39]

## Target Funding to National Economic Power Industries

The science funding system is agnostic about the challenge of national advanced-industry competitiveness. But it no longer makes sense to treat all scientific disciplines the same.

This differentiation was the guiding principle behind the CHIPS and Science Act when it identified 10 key technologies that the government should invest more in. This was a good step, but the effort is underfunded and managed in the NSF TIP program, where it did little to reorient NSF research directorates.

Prioritization will be strongly resisted by the science establishment as they circle the wagons to defend the current system. But these protests should be ignored. For example, the Trump administration's proposal to eliminate the NSF Directorate for Social, Behavioral, and Economic Sciences (SBE) has been widely criticized, but it makes sense as long as the savings are redirected to other key directorates, such as Engineering, Biological Sciences, Computer and Information Science and Engineering, and the Directorate for Technology, Innovation and Partnership.[40]

In addition, federal policy should give engineering research a larger share of support. Engineering research is critical to global competitiveness. But only about 15 percent of federal research funding goes to engineering. This should be doubled to at least 30 percent.[41]

At the same time, new funding should be targeted to areas of science, engineering, and technology that have direct implications for national economic power industries.

Finally, NSF and other federal agencies need to take much more seriously the national competitiveness component in "Broader Impact Assessments" in award review. In 2011, according to the NSF National Science Board, just 17 percent of proposals and reviewers considered competitiveness as an impact, while 45 percent considered increased participation of women and underrepresented minorities as one.[42] The board found:

> Across the four questions, the most common goals and activities were inclusion of women and underrepresented groups; education and training; and public outreach. Pre-K12 focused activities and societal benefits were in the second tier, U.S. competitiveness and partnerships in the third tier, and national security was lowest, with only four mentions across all the responses to the first four questions.

When scientists were asked which topics should be added going forward, the most common one was "social welfare and human health." In other words, competitiveness is window dressing established in the 1980s, when Japan was the foremost challenge, but is not really considered today.

### Better Measure Outcomes

The science establishment wants to measure success by how much funding it gets, or at best by articles in peer-reviewed science journals. This is okay only if you want a system with no real accountability.

As such, federal science agencies need to adopt and use better metrics of success. These can be, for example, measures of transfer of discoveries to the commercial marketplace, as the Association of University Technology Managers publishes every year.[43]

A key measure should be industry funding of university research. It is troubling that the rate of industry funding varies so dramatically. For states, North Carolina, Georgia, and Kansas led in the share of university research funded by industry, and Nebraska, Rhode Island, and Nevada were last. Among institutions, Duke, MIT, and Ohio State led, while University of Maryland, Michigan State, and Pitt were last.[44]

Having strong industry funding pays off economically. There are small, but positive correlations between the share of a state's university research supported by industry and its strength in key innovation variables such as high-tech startups (an R-value of 0.15), venture capital (0.28), high-tech jobs (0.14), and scientists and engineers (0.19).[45] Industry research funding is also associated with stronger university technology output, with a correlation of 0.26 between industry share and academic patents.[46] Moreover, interaction with industry as a STEM graduate student is associated with significantly greater likelihood of producing intellectual property (e.g., patents, invention disclosure, etc.).[47]

As such, Congress should make a number of changes. It should require programs like NSF's Engineering Research Center program to have at least some matching funds from industry as a condition of being awarded funding. Congress should expand the R&D credit for companies that fund university research and eliminate language that restricts the definition of basic research to projects "not having a specific commercial objective."[48] It should broaden the tax credit for energy research consortia to include all research consortia. Finally, it should make all business funding of university and federal lab research eligible for a 40 percent flat tax credit. One advantage of these more market-based approaches is that they let industry have more of a say in the kinds of research that is funded, and they better align academia to real-world issues and problems.

Federal funding agencies should tie a small portion of total higher education funding to how well individual universities do at obtaining industry funding for R&D, as some other nations have done. The UK's Research Excellence Framework includes an "impact" component that assesses commercial and societal impact of research, including patents, spinouts, and industry partnerships. Australia's engagement and impact assessment system scores universities on industry engagement, income from industry, and impact case studies. Chinese university funding and researcher evaluation increasingly weight patents, technology transfer, and enterprise partnerships.

Finally, we need to increase the importance of commercialization activities at federal labs and research institutes. America's federal laboratories are insufficiently incentivized to invest time, energy, and resources in facilitating technology transfer. DOE lab planning guidance includes a dedicated "Technology Transitions, Commercialization, and Partnership Strategy" section asking labs to describe their CRADA, ACT, and Strategic Partnerships Projects activities and how these tie into lab strategy. But that's a planning-narrative requirement, not a scored performance criterion on par with the eight goals. It needs to be an enforced performance requirement tied to funding.

## More Science and Technology Partnerships With Allies

The China challenge is so large (if part because China has a huge population) that the United States can not hope for success if it does not partner with allies. As such, Congress and federal agencies need to work to expand joint research initiatives with allies. These activities could include partnering in areas like robotics and aerospace, AI use, and developing a shared network of advanced-industry centers in which firms from both countries can participate in each other's programs, and joint participation in national science programs. A country could qualify for formal participation if it 1) takes steps similar to the United States in limiting knowledge transfer to the PRC, and 2) provides an appropriate share of funding.

### Limit China's Access to U.S. Scientific and Technological Knowledge

The U.S. system sees science as a global good, not a weapon in a techno-economic war and so it is lax on restricting PRC access to U.S. technological knowledge. Any new system should work to limit the ability of China to access U.S. knowledge and capabilities. As ITIF has documented, there are a number of steps Congress and the administration should take to limit scientific and technical cooperation with China.[49]

#### University and Government Research Policies

The framework by which U.S. and Western universities generally govern themselves no longer works. During the Cold War, it was widely accepted that universities should work to limit knowledge transfer to the Soviets. University policies were significantly adjusted to align with national security priorities, spurred by federal funding and public anxiety.

But with the fall of the Soviet Union, universities and even government research laboratories embraced a globalist vision of knowledge. In this vision, science is a global good. More collaboration is better. And universities, especially private ones, owe little allegiance to the nation, and much to the world as a whole. This is especially true after the declines in federal and state government support to universities, with most universities now, like most companies, looking out first and foremost for their bottom lines, and not the support of U.S. national techno-economic power.

At the same time, colleges and universities are desperate for revenue, even if that comes from Chinese students, companies, or the CCP. As such, the most important change that needs to happen is for widespread acceptance by U.S. universities that China is an adversary, not a customer. Because of strong incentives for universities to pursue their own self-interest rather than national interest, the federal government will need to play a stronger role. There are many steps it needs to take.

Congress could start by limiting Chinese nationals from obtaining postdocs at universities and federally funded research and development centers (FFRDCs). Many Chinese nationals obtaining postdoctoral positions in the United States do so after graduating from a U.S. university. And historically, a high share has stayed in America, contributing to the U.S. innovation base and not contributing to China's. But some Chinese nationals come to study as postdocs after graduating in China. Many of them go back to China, and the United States does not benefit. In fact, key knowledge these students acquire in the United States is now used in China.

While NSF does not collect data on the nationality of postdocs, many are from other nations. For example, 55 percent of postdocs at federally funded R&D centers are temporary visa holders.[50] Universities and FFRDCs should be required to report the country of citizenship of postdocs, and the government should track their later decisions to determine whether they stayed in the United States or went back to home countries, especially China. At the same time, where universities and FFRDCs are not able to hire Americans, they should try to hire postdocs from allied nations or non-adversary nations such as India, and not from China.

Congress should ban Chinese funding of U.S. research universities. While China has proved that it can innovate, it often relies on U.S. intellectual property (IP) and research to advance its own national technology innovations. One way it does this is by funding U.S. university research. Chinese-funded research conducted in the United States is taken back to China, hurting U.S. competitiveness. There is evidence that the CCP funds American universities to advance its agenda—and currently there is no robust legal tool to compel recipients to disclose their funding sources.[51]

Congress should make federal funding of university research contingent on universities not receiving Chinese funding for research.[52] And this ban should also extend to pass-throughs where China funds a U.S. entity that then funds the U.S. research institution.[53] As such, Congress should pass the Defending Education Transparency and Ending Rogue Regimes Engaging in Nefarious Transactions (DETERRENT) Act to expand the oversight and disclosure requirements regarding Chinese funds channeled to U.S. universities and research institutions.

The DETERRENT Act would close loopholes in inadequate reporting and enforcement of federal laws on university disclosures regarding gifts and contracts from foreign entities.[54] This bill proposes lowering the reporting threshold to $50,000. The DETERRENT Act also would prohibit universities from entering into contracts with a foreign country of concern or with a foreign entity of concern without obtaining a waiver and would hold private research institutions accountable for their financial partnerships by requiring disclosure of concerning foreign investments in their endowments.[55]

Congress should also require disclosure of U.S. faculty research with Chinese researchers related to national power industries. ITIF has reported that PRC espionage is a strategy that extends from state intelligence agencies to nominally private firms, and that Beijing coordinates cyber, human, and corporate channels to steal U.S. industrial and defense technologies.[56] The PRC's espionage ecosystem is aided by the U.S. research environment, which privileges the free flow of ideas and researchers, allowing China to recruit (or coerce) talent trained in America and to have some of this talent engage in IP theft and technology transfer.

A 2024 report from the House Select Committee on the CCP reveals that Georgia Tech received $17 million from an entity affiliated with Tianjin University, while UC Berkeley received nearly $22 million from entities affiliated with Tsinghua University.[57] These contracts were discovered years after they were in place, and both involve advanced research on dual-use technologies. The failure to report is due to weak enforcement of Section 117 of the Higher Education Act. This section requires the disclosure of gifts and contracts over $250,000 from foreign entities. However, the auditing is limited to the Department of Education, and it is possible to obscure the true sources of funding by bypassing funds through intermediaries.[58]

At minimum, universities should be required to disclose in real time all research partnerships with researchers or companies in China. Where those partnerships are with entities of concern in China, People's Liberation Army (PLA) military institutions, or affiliated institutions (e.g., the "seven sons of national defense"), the researchers should be required to first get permission from NSF.

Congress should also approve the Securing American Funding and Expertise from Adversarial Research Exploitation Act of 2025 (SAFE Act) to block U.S. federal grants to scientists with a history of collaborating with hostile foreign countries, such as China. This bill is drafted in response to a House China Select Committee report that identifies over 50 partnerships between U.S. universities and entities associated with the CCP, including joint degree programs with China's Seven Sons of National Defense—a group of Chinese universities selected to focus on military and defense research and research on sensitive, dual-use technologies such as submarine engineering, aircraft power engineering, and mechanical design, manufacturing, and automation.[59] The SAFE Act would ban federally funded science, technology, engineering, and mathematics (STEM) research by researchers with a history of collaborating with PRC-associated entities, ban DOD funding for universities that partner with adversaries, and, similar to the DETERRENT Act, impose stricter disclosure requirements on collaboration with entities associated with adversaries.[60]

In addition, a 2023 Select Committee on the CCP report outlines further recommendations to "strengthen U.S. research security and defend against malign talent recruitment."[61] Among its recommendations, the report suggests improving cross-agency disclosure guidance produced under National Security Presidential Memorandum 33 (NSPM-33) by NSF. This would require all recipients of federal research funding, including their personnel and subcontractors, to disclose their relationships with entities and interests with foreign adversaries for a certain period (e.g., the past five years). In addition, the Select Committee, to help agencies in the vetting process, has proposed the creation of "an unclassified database using open-source information to keep track of PRC research entities that engage in defense and military research and civil-military fusion programs."[62] Congress should ban cooperation with CCP/PLA-associated entities and there should be a presumption of research being problematic, and institutions should be required to obtain waivers to proceed.

The National Science Foundation recently announced new guidance for universities on working with parties on the variety of U.S. entities list, prohibiting such partnerships.[63] This is welcome, but frankly a decade overdue. But it does not go far enough. It makes sense that the PLA-affiliated universities are on an entity list, but what about Tsinghua University and Peking University which are not?

This gets to a key challenge in the entity list system: The listing mechanism is transaction-evidentiary, not capability-based. BIS additions under Part 744 require "reasonable cause to believe, based on specific and articulable facts" tied to a *documented* activity—a specific procurement, a specific lab's involvement in a specific weapons or AI program, a specific export violation. But this is still a legacy of the old system tied to WMD and military capabilities, not broad-based technological competition, and specific cases, not overall institutions. As such, NSF should go further and require universities to receive approval for any research with Chinese universities that is related to dual-use technologies.

### Institute Better Screening of Chinese STEM Students

There are vastly more Chinese students studying in the United States than U.S. students studying in China. On the one hand, they gain knowledge here that they can use if they go back. On the other hand, if they stay in the United States (and do not transfer knowledge to China), they are a net plus for the U.S. innovation ecosystem, and conversely, their presence weakens China by reducing talent levels in China. Even if they go back to China, they have been exposed to the U.S. system of freedom and democracy and perhaps would want to support that in China at some point in the future.

However, there are two challenges. The first is that some students return to China. But that does not mean we should cut off flows. If they did not come to the United States, they would likely go to other nations with strong higher education systems, and U.S. research university competitiveness would decline. Moreover, the rate of staying for Chinese STEM students remains quite high. One study finds that, of a sample of 100 Chinese AI researchers studying in the United States in 2019, 87 percent remained in the United States in 2025.[64] However, this is still a relatively limited time period, and we don't know how many plan to return in the next decade. One 2024 study of Chinese students enrolled in U.S. higher ed found that only 43 percent intend to stay in the United States.[65]

At the same time, there is a share of Chinese students who are "bad apples." They pressure fellow Chinese students to toe the CCP party line. They steal U.S. IP. They are closely tied to the Chinese military or intelligence services.[66] Indeed, the porousness between Chinese academic institutions and the PRC government has proven to be an ongoing problem. The United States in 2025 announced that it would start revoking visas of Chinese students with connections to the CCP or studying in critical fields. This should be expanded. Multiple cases have highlighted specific Chinese schools whose students have been linked to the theft of trade secrets and proprietary information. The United States should blacklist these Chinese institutions and reject their students' visa applications.

What is the ratio of "bad apples" to "good"? Is it changing? We do not know. But this should not be a binary choice between limiting or banning Chinese students and opening the doors to all with no assessment. Universities and FFRDCs need to do more due diligence on Chinese STEM students coming here, especially for graduate programs. They need to better monitor for risks of IP theft. The federal government should require universities to be more transparent: How many Chinese are enrolled in what disciplines? And it needs to provide analytical tools to universities and FFRDCs to make better decisions on individual students.

One of the reasons why universities are so opposed to any limits on Chinese students is that many rely on them as a source of tuition revenue and low-wage research assistance. Given the cuts in state and federal funding for universities, this is understandable. But all else equal, universities and related programs should try to recruit students from other nations, such as India. Related to this, the U.S. government should pressure foreign fellowship and other tuition assistance programs to not include Chinese students and instead prioritize students from other nations.

### Restrict the U.S.-China Science and Technology Agreement

President Jimmy Carter mistakenly furthered opening up to China in 1979, and one step was to sign the U.S.-China Science and Technology (S&T) Agreement. The idea was that by sharing science and technology, China would move into the U.S. orbit and relations would become friendlier. Like so much of U.S. policy toward China over the last 50 years, it was based on wishful thinking and naïveté. China didn't want to become like us. It wanted access to our science and technology to advance its national power.

Over the years, the S&T agreement—a process whereby federal agencies engage in partnerships with Chinese agencies and scientists—has led to Chinese advances in national power industries. As a 2014 report from the U.S.-China Economic and Security Review Commission notes:

> In contrast to the U.S. approach of utilizing S&T cooperation primarily as a tool of diplomacy, China uses S&T engagement as a component of a national strategy to build scientific capabilities. This has enabled the rapid development of China's S&T capabilities and threatens the United States' status as the world's leading scientific power. The report also identifies some national security challenges, including the transfer of sensitive technology through espionage and other means that have emerged in the context of bilateral S&T cooperation.[67]

Indeed, proponents of the agreement—who are also proponents of engagement with the PRC—point to cooperation on things such as influenza (which clearly did not work out well, given the fact that China was the source of COVID), birth defects, and air pollution. But they do not mention projects on EVs, agricultural biotechnology, human biotechnology, and nanotechnology, or help with technology standards (which China now manipulates).

When the agreement was last up for renewal, the Biden administration negotiated certain changes, but these had nothing to do with preventing transfer of key knowledge to China.[68] To be sure, there may be areas where cooperation is reciprocal and does not lead to advances in key technology areas supporting Chinese national power industries. As such, the Trump administration should not cancel the agreement. But it should change the agreement to limit it to areas that do not provide China with any assistance in technologies related to national economic power industries. Endangered species research sharing, yes. EV research sharing, no.

## CONCLUSION

The world has fundamentally changed in the last decade. The utopian vision of globally integrated, democratic, free-market economies working together in harmony has not materialized. The belief that China could not innovate has proved to be false. And the belief that the United States would continue to lead in advanced-technology innovation and production has also proven to be false.

These new realities require bold reforms in the U.S. research system. Opponents, especially defenders of the university research system, will argue that it's the unfettered pursuit of knowledge that drives innovation and even national competitiveness. They will argue that government can't pick winners. They will argue that all disciplines should be treated equally. That may have made sense in the past. It no longer does.

And they will argue that science will be politicized based on who is in the White House.[69] Indeed, they frame OMB proposals in the Trump administration as "an attack on American science" and claim that the White House will "destroy science."[70] If anything will "destroy" science, it will be reduced federal funding, coupled with Chinese destruction of U.S. science-based industries.

It is also important to recognize that science has already been politicized; the Biden administration sought to use science to advance its DEI goals. And the idea that the science community has not politicized itself is not borne out by the evidence.[71] A *Nature* magazine editorial stated that "The enterprise of science has been—and remains—complicit in systemic racism."[72] And leading science and tech policy journals, including *Issues in Science and Technology* and the *MIT Technology Review* have taken a turn to the progressive left in recent years.[73]

Meanwhile, the science community is surprised that there is a reaction—perhaps an overreaction—by the Trump administration to this politization of science. Similarly, given the long-standing disregard of the U.S. academic community working with adversaries, including China, is it any surprise that OMB's proposed rule takes a strict approach to limiting cooperation with adversaries?[74] Indeed, the failure of the science community to adequately police itself on matters of both DEI and working with China, not surprisingly has produced stringent regulations in response.

The reality is that neither Democratic nor Republican administrations should politicize science in terms of imposing their ideological views on the enterprise. But before that can happen, the U.S. science enterprise will have to take a hard look at itself and return to objectivity. Even if it does so, which seems unlikely, shifting the science establishment to focus on areas critical to competing with China is not politization of science, unless the science community believes that politization is when democratically elected representatives have priorities for what kind of science taxpayer-funded scientists conduct. The sad reality is that this is exactly what the science community believes.

Thank you for your consideration.

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