December 24, 2025

The Honorable Michael Kratsios
Director
Office of Science and Technology Policy (OSTP)
Executive Office of the President
1600 Pennsylvania Ave, NW
Washington, DC 20501

RE: Response to Request for Information (RFI) on Optimizing the Federal Research Enterprise and Strengthening American Innovation

Dear Director Kratsios,

IEEE-USA is pleased to submit the following recommendations in response to the Request for Information regarding Federal policy updates to accelerate the American scientific enterprise. As the largest organization of technical professionals in the United States, representing over 150,000 engineers, scientists, and allied professionals, IEEE-USA is uniquely positioned to offer perspective on the legislative, regulatory, and structural reforms necessary to maintain American technological dominance.

Our response outlines a comprehensive strategy to modernize the "operating system" of American science. We believe that to compete effectively in an era of intensifying global competition, the Federal government must pivot from incrementalism toward a high-risk, high-reward research culture that leverages modern computational tools and regional talent.

Key highlights of our recommendations include:

- **Reforming Peer Review:** Implementing "Golden Ticket" mechanisms to empower individual reviewers to champion unorthodox, paradigm-shifting ideas that traditional consensus panels often filter out.
- **Modernizing Innovation Frameworks:** Moving beyond linear Technology Readiness Levels (TRL) to adopt contemporary nonlinear models that better reflect the complex interactions between academia, national labs, and the private sector.
- **Strengthening Intellectual Property:** Urging Congress to pass the Patent Eligibility Restoration Act (PERA) and the PREVAIL Act to ensure that biotech and software innovations receive the robust protection necessary to attract private investment.
- **Human Capital & Talent:** Addressing the STEM workforce bottleneck by "stapling green cards to diplomas" for advanced degree holders and utilizing digital twin technology to democratize technical training.

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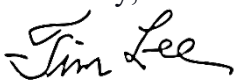
- **AI-Enabled Discovery:** Codifying the National AI Research Resource (NAIRR) to ensure that researchers at small institutions command the same computational power as large technology incumbents.
- **Research Security:** Establishing a National Science Cyber Command Center (NSC3) to move toward "compliance-by-design," protecting sensitive IP from state-sponsored threats without overbalancing the administrative load on researchers.

To maintain global leadership, the United States must embrace a strategy of funding the non-linear "winding path" of unconventional technologies rather than retreating at the first sign of technical friction. By streamlining the federal research operating system and reducing the administrative overhead that currently consumes researcher's time, we can redirect a massive reservoir of American intellectual capacity back toward discovery and commercial deployment.

IEEE-USA stands ready to assist the OSTP in further developing these frameworks to ensure that the benefits of federal research—from wage growth to local supply chain stability—reach all Americans. We welcome any further dialogue on these critical issues and please direct any questions to Ryan Cunius at (202) 530-8339 or r.cunius@ieee.org.

Sincerely,



Tim Lee
2025 IEEE-USA President

Optimizing the Federal Research Enterprise for High-Impact Innovation (i, vi)

(i) What policy changes to Federal funding mechanisms, procurement processes, or partnership authorities would enable stronger public-private collaboration and allow America to tap into its vast private sector to drive use-inspired basic and early-stage applied research better?

(vi) What reforms will enable the American scientific enterprise to pursue more high-risk, high-reward research that could transform our scientific understanding and unlock new technologies, while sustaining the incremental science essential for cumulative production of knowledge?

To maintain American leadership in science and technology, we must fundamentally reengineer our grantmaking processes to tolerate higher risk and optimize for breakthroughs rather than incrementalism. From an IEEE-USA perspective, the current system suffers from "design by committee" conservatism; we propose a systems-level reform focusing on data-driven metrics, algorithmic assistance, and a cultural shift in peer review.

1. Developing A Research Strategic Plan:

Even before its research expenditures became comparable to those of the USA, China was advancing rapidly in key technology areas. Now, it leads in many[1]. This is due, at least in part, to China's focused strategy to gain dominance in these key areas. To compete in the future, the USA must develop its own long-range strategic plan and allocate funds accordingly.

2. Assuring Availability of all Research Results

Engineering relies on knowing what doesn't work as much as knowing what does. The federal government should therefore work with journals and publishers to normalize the publication of negative results. This prevents duplicative failed experiments, discourages academic dishonesty, and creates a more transparent research ecosystem.

3. Re-Engineering Peer Review

It is widely recognized that consensus-driven peer review panels regress to the mean, filtering out high-variance, high-reward proposals. To counter this, we propose structural and cultural changes:

[1] https://www.nature.com/articles/d41586-025-04048-7

- **The "Golden Ticket" Mechanism:** We recommend piloting a model in which individual reviewers are granted a "Golden Ticket"—the ability to unilaterally champion a highly unorthodox proposal that shows strong promise, even if the rest of the committee rejects it. This safeguards outlier ideas that often lead to paradigm shifts.
- **Invest More Federal Money for Younger Researchers:** Assure a significant amount of federal money for promising researchers in their first 5 years after obtaining their final advanced degree. In response to the National Academies' "Rising above the Gathering Storm" report[2], the Air Force Office of Scientific Research established its Young Investigators Program[3], which has since identified and funded many outstanding new researchers. Doing so injected greater novelty into the project portfolio and allowed these young professionals to establish themselves earlier in their careers.

4. Stabilize Funding for Fundamental Research

To protect long-term innovation from the volatility of political cycles, Congress should enact mechanisms that insulate critical R&D funding from short-term appropriations battles.

- **Multi-Year Appropriations:** Implementing longer funding cycles for fundamental research ensures that the private sector and universities have the confidence needed to invest matching funds and long-term resources.

5. Promote Sustainable, Expert-Led Operations

While aligning research with national goals is necessary, transformative breakthroughs often require implementation driven by those with deep subject-matter knowledge and sustained funding (e.g., spanning multiple planning cycles, persisting through unexpected technical hurdles).

- **Technical Authority:** Program managers and domain experts should maintain lead decision-making authority over scientific direction.
- **Sustained Technical Continuity:** The federal government should develop a framework for long-term (10+ years) public-private partnerships to advance national science and technology priorities.

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[2] https://www.nationalacademies.org/projects/PGA-COSEMPUP-18-P-43/publication/11463

[3] https://www.afrl.af.mil/About-Us/Fact-Sheets/Fact-Sheet-Display/Article/2282106/afosr-funding-opportunities-special-programs/#anchor2

- **Expand Use of Expedited/Special Hiring:** Expand the use of expedited and special hiring processes to hire technical experts across the government and pursue long-term reforms to compensate highly qualified candidates competitively.
- **Independent Technical Advice for Congress**: Encourage Congress to add to House and Senate rules mandatory consultation of the Government Accountability Office's Science, Technology Assessment, and Analytics (GAO-STAA) team for bills with potential impacts on the U.S. science, technology, or industrial enterprise (similar to existing requirements to obtain JCT/CBO scoring for bills with tax or fiscal implications). Additionally, Congress should increase funding for and encourage the utilization of GAO-STAA's resources throughout the legislative process.

Supporting Bottom-Up Innovation (ii, iii, iv)

(ii) How can the Federal government better support the translation of scientific discoveries from academia, national laboratories, and other research institutions into practical applications? Specifically, what changes to technology transfer policies, translational programs, or commercial incentives would accelerate the path from laboratory to market?

(iii) What policies would encourage the formation and scaling of regional innovation ecosystems that connect local businesses, universities, educational institutions, and the local workforce—particularly in areas where the Federal government has existing research assets like national laboratories or federally-funded research centers?

(iv) How can Federal policies strengthen the role played by small- and medium-sized businesses as both drivers of innovation and as early adopters of emerging technologies?

To effectively translate scientific discovery into economic reality, the U.S. government must modernize its understanding of Science & Technology (S&T) development. Decades of research in innovation economics view innovation as the result of complex interactions between an ecology of actors and emphasize that systemic barriers (regulatory, financial, and physical), stifle S&T progress even if the nation's research enterprise is productive. We recommend a cohesive strategy focused on three pillars:

1. Institutionalizing Nonlinear Frameworks of Innovation

The government's widespread use of linear models like Technology Readiness Levels (TRL) ties America's innovation strategy to an outdated framework that academia has widely discredited since the early 1970s.

- **Adopt Contemporary Innovation Models:** The Administration should direct all agencies to transition to contemporary innovation models, such as the OECD National Innovation System or the ISO 56002 standard on innovation management systems. These approaches explain the core principles that the government should use to inform its innovation strategy and capture the true complexity of the innovative process.
- **Increase Autonomy in Industry-Facing Programs:** The NSF TIP is actively developing its Tech Labs and Tech Accelerators initiatives—two new, exciting programs that will work closely with the private sector and have the potential to supercharge the nation's innovation ecosystem. These programs will not be able to "pursue research at breakneck speed without needing to frequently stop and apply for additional grant funding with each new idea or development" under the NSF's current financial and administrative procedures. Congress should empower the NSF's Tech Labs and Tech Accelerators initiatives with independent control of funds, procurement, hiring, governance, etc., needed to emulate frameworks with proven success like Germany's Fraunhofer Society, Bell Labs, EUV LLC, and NIST's Manufacturing USA

2. Fostering Bottom-Up Regional Hubs

Regional industrial ecosystems thrive when they are nimble and driven naturally by local trends rather than created artificially by top-down federal mandates. Uncoordinated programs can hurt investor confidence by sending mixed signals to the private sector. For instance, the Economic Development Administration selected the Colorado-New Mexico region as its Quantum Tech Hub at the same time as NSF chose the Illinois-Wisconsin-Indiana region as it select region for quantum innovation.

3. Supporting SMBs

Small and Medium-Sized Businesses (SMBs) face three distinct hurdles: administrative barriers, a critical shortage of physical infrastructure, and high barriers to obtaining federal SMB funding.

- **Fund Physical Infrastructure Initiatives:** The federal government should develop incentives (e.g., grants, favorable loans) to support state and/or local

initiatives that provide startups with affordable warehouse space with heavy-duty electricity and water access, which are increasingly scarce and cost prohibitive.

- **Share Expensive Research Resources ("ShareLab" & NCX):** We recommend establishing "ShareLab USA" and a "National Compute Exchange" (NCX) to allow SMBs to book federally funded facilities (wind tunnels, electron microscopes, etc.) and rent spare computing power.
- **Simplify Grantmaking with Micro-Grants:** To lower the barrier to entry for innovation, scientific federal agencies should create SBIR/STTR pilot programs to issue $50k "micro-grants" with standardized or straightforward contracts and milestone-based payments to support small innovators who cannot navigate complex grant compliance requirements.

AI in Scientific Research (viii)

(viii) How can the Federal government leverage and prepare for advances in AI systems that may transform scientific research—including automated hypothesis generation, experimental design, literature synthesis, and autonomous experimentation? What infrastructure investments, organizational models, and workforce development strategies are needed to realize these capabilities while maintaining scientific rigor and research integrity?

We view the integration of AI into science not just as a software upgrade but as a fundamental restructuring of scientific research. We must move beyond "black box" models toward systems that are transparent, reproducible, and accessible. To prepare for this transformation, the Federal government must invest in infrastructure, standards, and verification.

1. Democratizing AI Access

Many resources essential for embedding AI into R&D are currently limited to large technology companies, preventing America’s researchers and small businesses from taking advantage of this transformative technology. The Genesis Mission establishes the necessary supercomputing engine via the American Science and Security Platform. Still, its success is contingent upon the formal passage of the National AI Research Resource (NAIRR) Act.

- **Congress Should Pass the NAIRR Act:** NAIRR aims to be the "National Science Data Cloud," consolidating databases, compute resources, foundational AI models,

and cloud infrastructure into a single, integrated system. By codifying NAIRR, the U.S. government ensures that a researcher at a small state university command the same computational power as a private tech giant opening the Genesis architecture to the entire nation.

2. Safely Unlocking Personally Identifiable Information for Research

Data privacy (e.g., HIPAA) and other constraints often block high-value research that requires access to large amounts of personally identifiable information that can be linked to an individual.

- **Establish a Government-Accredited Marketplace for Synthetic Data:** The U.S. government should put into NAIRR a marketplace of artificial datasets that use AI to statistically mirror real populations (preserving correlations and patterns) without containing a single record of a real human. The government should work with Standards Development Organizations (SDOs) to establish the validity of these datasets. This certification would guarantee that the synthetic data is statistically accurate for peer-reviewed research and mathematically proven to preserve privacy.

3. Developing AI Built for Science

Current "generative" AI models are probabilistic—they guess the next likely token. In the scientific domain, "likely" answers are insufficient; we need *correct* answers that are hardwired with the laws of physics and the scientific method.

- **Increase AI Transparency With "Self-Verifying AI":** We advocate funding "Self-Verifying AI" systems that "show their work" and let us trust AI science, not AI algorithms. Symbolic AI (NeSyAI) is one example of verifiable AI models that fuse the pattern-recognition power of neural networks with the logical reasoning of symbolic AI. A neural network might predict a new protein structure, but a symbolic component is needed to mathematically verify that the structure obeys the laws of physics and thermodynamics.
- **Free Up Human Capacity by Using AI For Menial Tasks:** Federal funding should target research & development of open-source AI agents capable of reliably executing menial tasks, such as conducting literature reviews, generating code for experiment control, and cleaning raw data. These tools must be built on open standards to prevent vendor lock-in. An "NIH-GPT" or "NSF-CoPilot" should be a public good, ensuring that the efficiency gains of AI are available to the entire

American scientific enterprise. Similar ideas are expressed in the new National Academies' report "Foundation Models for Scientific Discovery and Innovation."

Removing Systemic Barriers to Innovation (ix, x)

(ix) What specific Federal statutes, regulations, or policies create unnecessary barriers to scientific research or the deployment of research outcomes? Please describe the barrier, its impact on scientific progress, and potential remedies that would preserve legitimate policy objectives while enabling innovation.

(x) How can Federal programs better identify and develop scientific talent across the country, particularly leveraging digital tools and distributed research models to engage researchers outside traditional academic centers?

As engineers and scientists, we encounter firsthand inefficiencies arising from the complexity of the federal research enterprise. The nation's academic system is operating well below its theoretical efficiency. It is strangled not by a lack of ideas but by systemic friction from a combination of outdated statutes, ambiguous property rights, and regulatory bottlenecks.

To maintain global leadership, we must reconfigure the operating system of American science. We identify four critical areas where federal policy creates unnecessary barriers, along with specific, engineering-focused remedies.

1. Restoring Intellectual Property to A Mechanism That Supports Innovation

Over the past two decades, Supreme Court interpretations of patent eligibility, combined with Patent Trial and Appeal Board (PTAB) procedures and the limited use of injunctive relief, have allowed incumbents to weaponize American intellectual property (IP) to raise barriers to entry for rivals strategically. This, alongside legal ambiguity around IP, drives capital away from funding potential breakthroughs and towards sectors with less risk. The Patent Eligibility Restoration Act (PERA) and the Promoting and Respecting Economically Vital American Innovation Leadership (PREVAIL) Act make necessary changes to the U.S. patent system.

- **Congress Should Pass PERA:** 35 U.S.C. § 101 defines inventions eligible for patent as "any new and useful process, machine, manufacture, or composition of matter…" with the exception that laws of nature (e.g., gravity) or abstract ideas (e.g., long division) couldn't be patented. The Supreme Court's decisions in the 2012 Mayo and 2014 Alice cases twisted these exceptions and have made it

prohibitively difficult to obtain a patent in the U.S., particularly for biotech and software. *Mayo* determined that the discovery of a new drug is merely the identification of a natural correlation, not the creation of a patentable invention; *Alice* set precedent that most software inventions, including AI, simulations, bioinformatics, and control systems, are classified as unpatentable "abstract ideas" for their mathematical foundations. PERA clarifies that practical applications of natural laws or abstract ideas are patent-eligible and will restore the U.S. patent system's value for biotech and software innovations without lowering IP quality standards.

- **Congress Should Pass the PREVAIL Act:** The 2011 America Invents Act created Inter Partes Reviews (IPRs) that allow third parties to challenge patents through "mini trials" at the PTAB. In making IPRs, Congress sought to provide a faster, cheaper way to challenge bad patents outside federal courts; in practice, they allow *uninvolved* companies to challenge patents *multiple times* using a *lower burden of proof than courts* on *artificially short timelines*. The resulting "death by a thousand cuts" environment allows wealthy incumbents to invalidate patents of smaller competitors, thereby slashing patent security and disincentivizing innovation easily and repeatedly. The PREVAIL Act would limit PTAB challenges to parties directly impacted by a patent, reduce duplicative petitions, and align PTAB's burden of proof with federal courts to prevent procedural harassment while preserving PTAB as a tool to invalidate truly weak patents.
- **Congress Should Re-Normalize the Presumption of Injunctive Relief:** Largely driven by *eBay v. MercExchange (2006)*, courts no longer presume injunctive relief. Instead, the plaintiff must satisfy a four-factor test to qualify for injunctive relief that, in practice, makes it difficult to support small innovators over large incumbents. Congress should take action to balance uniform judicial proceduralism with an individual's Constitutional right to intellectual property.

2. Exploiting Immigration to Address the Human Capital Bottleneck

The United States currently funds the training of immigrants into world-class engineers and scientists only to force many of them to leave, effectively subsidizing the workforce of our geopolitical rivals. This counterproductive system is based on the Immigration and Nationality Act (INA), specifically the caps on Employment-Based Green Cards and the lack of "Dual Intent" for student visas.

- **Facilitate Immigration of STEM Talent:** Congress should enact the "staple green cards to diplomas" strategy by statutorily exempting advanced STEM degree holders from Green Card caps and by codifying Dual Intent. This strategy prioritizes permanent residency over temporary H-1B expansion that restricts worker mobility and suppresses wages through below-market prevailing wage floors. Focus must be on providing top talent with the immediate stability and freedom of a Green Card rather than expanding a flawed guest worker program that creates uncertainty for talent and market distortion for domestic workers.

3. Reducing Administrative Overhead

Congress and the Administration should act on the National Academies' recommendations in their recent report "Simplifying Research Regulations and Policies: Optimizing American Science"[4], which elaborates how "excessive, uncoordinated, and duplicative policies and regulations surrounding research are hampering progress and jeopardizing American scientific competitiveness. Estimates suggest the typical U.S. academic researcher spends more than 40 percent of their federally funded research time on administrative and regulatory matters, wasting intellectual capacity and taxpayer dollars."

4. Financing Research Like a Marathon, Not A Sprint

Thirty years ago, the U.S. led the world in developing hypersonic flight technologies. But the government's retreat from risk tolerance and failure to sustain funding through the ups and downs of the applied research phase allowed China and Russia to seize the advantage. Today, they field capabilities that the U.S. is still scrambling to match. The loss of American dominance in hypersonics should serve as a stark strategic warning. To prevent this history from repeating in emerging fields like fusion or quantum networking, the federal government must reject short-termism in favor of Strategic Endurance.

- **Fund The "Strategic Endurance" of American Research:** Agencies must be empowered to take calculated risks and "stay the course" over multi-decade horizons. The U.S. government alone can finance transformative research through the inevitable setbacks that arise when trying to bridge theory and prototype. Pulling funding at the first sign of technical friction or budget pressure is a strategic error. Instead, America must fund the winding path towards developing unconventional technologies, not just research's immediate results. Technology

[4] https://www.nationalacademies.org/publications/29231

will mature one way or another, and the United States must ensure it is the nation that harvests its strategic benefit.

Reinforcing the Foundations of Innovation (vii, xi)

(vii) How can the Federal government support novel institutional models for research that complement traditional university structures and enable projects that require vast resources, interdisciplinary coordination, or extended timelines?

(xi) How can the Federal government foster closer collaboration among scientists, engineers, and skilled technical workers, and better integrate training pathways, recognizing that breakthrough research often requires deep collaboration between theoretical and applied expertise?

Breakthrough research increasingly requires large teams, long time horizons, and close integration between theory, engineering, and skilled technical work. Yet the nation's research system remains geographically and institutionally concentrated, limiting both the flow of real-world problems into research agendas and the diffusion of new knowledge back into practice. To strengthen the innovation system, federal policy should expand the functional reach of universities and national laboratories beyond their immediate local ecosystems and better integrate regional talent, firms, and training institutions into the research enterprise.

1. Using Distributed Institutions to Connect Research and Practice

Federal programs should treat small firms, community colleges, and national laboratories as *regional interfaces* between frontier science and real-world application.

- **Leverage SBIR/STTR as Testbeds for Applied Research:** Congress should permanently reauthorize SBIR and STTR. Small businesses—often located outside major tech hubs—are well-positioned to surface practical problems for academia to solve and to test early scientific ideas. Strengthening the role of SBIR and STTR as applied research partners would allow theoretical researchers to engage with the world outside of a lab and to give local technical talent exposure to advanced science and technologies.
- **Fund Community Colleges to Build a Technical Workforce:** Commercializing new technologies requires skilled technicians, not just PhDs. Federal grants should support partnerships between community colleges, industry, and research institutions to develop curricula for new workers, upgrade lab equipment, and retrain existing workers so regions can coordinate absorption and deploy new technologies.

- **Expand The Role of National Laboratories as Regional Anchors:** National labs should be encouraged to serve as regional training and collaboration hubs by offering more apprenticeships, fellowships, and short-term placements that connect local workers and firms to their advanced research capabilities. Labs should also source goods and services locally to strengthen regional innovation ecosystems.

2. Strengthen Regional Feedback and Talent Identification

Innovation systems work best when research agendas reflect real needs and when career pathways are broad and made visible even to K-12 students.

- **Communicate with Regional Intermediaries:** Economic development organizations, chambers of commerce, and workforce boards can serve as intermediaries that communicate regional industry needs to researchers and inform communities about emerging technical opportunities.
- **Promote Early and Clear STEM Career Pathways:** Improved K–12 STEM education remains essential for building a future workforce and educating citizens on how to engage with advanced technologies. Federal efforts should seek to raise awareness and clarify the connection between regional technical career paths and local industries, and their viability as well-paying professions.

3. Digital Democratization & Infrastructure: The "Virtual" Research Center.

Digital tools can reduce geographic barriers and scale access to high-quality technical training and collaboration.

- **Improve Access to Communications Infrastructure:** Investments in broadband and fiber infrastructure are foundational to innovation, particularly in enabling rural and underserved communities to participate in the national innovation ecosystem.
- **Develop Guidance on AI-Enabled Learning Pathways:** AI-based assessment and tutoring tools can identify non-traditional talent through skills rather than credentials and generate targeted curricula to help workers transition into technical roles more quickly. If used incorrectly, however, these tools could hurt the quality of education and workforce development. Federal guidance on how AI could best be integrated into learning would clarify for software developers how to approach such programs.
- **Spread Use of Immersive and Virtual Training:** AR and VR technologies can simulate expensive or sensitive environments—such as semiconductor cleanrooms or quantum testbeds—allowing students or early-career professionals anywhere to gain hands-on

experience and enabling firms to train job-ready workers without opening secure facilities.

- **Spread Use of Digital Twin Collaboration:** In addition to training, AR and VR technologies, when paired with digital twins and real-time connectivity, can allow engineers and technicians to collaborate in shared virtual environments before physical deployment, fostering a shared understanding between design and operations and accelerating technology transfer.

4. Structuring Collaboration & Academic Reform

To integrate training pathways and align research with practice, institutional barriers between "thinking" and "doing" must be lowered.

- **Diversify Advanced Degree Pathways:** The Federal government should encourage alternative doctoral and advanced degree models that recognize product development and commercialization instead of traditional dissertations, particularly in applied and industrially relevant fields. Private-sector collaborations can align these graduate projects with real industry challenges to prepare students for immediate workforce readiness and offer them additional opportunities to work with companies beyond internships, co-ops, etc.
- **Promote Bilateral Personnel Flow:** Programs should incentivize practitioner-educator exchange, enabling industry experts to teach and academic researchers to spend time in industrial settings. Evidence shows that researchers who both publish and patent are more effective at producing impactful work.
- **Elevate Middle-Skill Technical Roles:** Federal agencies should work with industry and professional societies to formalize and credential critical middle-skill roles (e.g., semiconductor process technicians, quantum technicians), signaling that these positions are essential complements to PhD-level research.
- **Tap Into Professional Societies as Intermediaries:** Professional societies can act as agile intermediaries by mentoring talent nationwide, validating training materials, and ensuring that curricula align with the technical needs of frontier research institutions.

Making Research Help All Americans (xii)

(xii) What policy mechanisms would ensure that the benefits of federally-funded research—including access to resulting technologies, economic opportunities, and improved quality of life—reach all Americans?

To ensure that the benefits of federal research reach all Americans, the government must move beyond measuring success solely by citations and patents. We propose a policy shift that quantifies the broader economic ripple effects of research—wage growth, local supply chains, and infrastructure stability.

By scaling successful models, such as the IRIS Consortium[5], and establishing designated Innovation Hubs, we can transform research centers into engines of regional economic prosperity.

1. Establishing a "National Research Impact Database" (Scaling the IRIS Model)

Currently, the societal benefit of research is often anecdotal. To systematically track benefits, the Federal government should adopt and scale the data infrastructure model pioneered by the Institute for Research on Innovation and Science (IRIS).

- **Create a Consortium:** We recommend creating a federal-university consortium dedicated to data-driven analysis of research investments.
- **Track the "Talent & Value Multiplier" (TVM):** Agencies should partner with the U.S. Census, professional societies, and universities to develop and track the TVM. This goes beyond scientific output to measure explicitly societal returns, such as:
    - **Workforce Trajectories:** Where do graduate students end up? (e.g., Are they starting local businesses?)
    - **Vendor Supply Chains:** Which local small businesses are supported by grant procurement funds?
    - **Wage Premiums:** How does research funding impact regional wage growth?

[5] https://iris.isr.umich.edu/

- **Track Impacts of Grant Money:** Mandate that grant recipients participate in the "National Research Impact Database," which provides a granular view of how federal dollars circulate through local economies.

Research Security (xiii)

(xiii) How can the Federal government strengthen research security to protect sensitive technologies and dual-use research while minimizing compliance burdens on researchers? To address the dual challenge of escalating espionage threats and rising administrative fatigue, we propose a shift from "compliance-by-checklist" to "compliance-by-design" through centralized infrastructure. Additional ideas for addressing this inherently challenging issue appear in the recent National Academies' report, "Assessing Research Security Efforts in Higher Education."[6]

1. The National Science Cyber Command Center (NSC3)

We propose the creation of a "National Science Cyber Command Center" (NSC3), jointly led by DHS, NSF, and NIST. Currently, research security is fragmented across individual institutions, leaving smaller labs vulnerable. The NSC3 would centralize defense by providing:

- **Real-time Threat Intelligence:** Direct alerts regarding specific state-sponsored actors targeting the US academic sectors.
- **The "24-Hour Zero-Day Shield":** An AI-driven platform with human oversight can generate and push patches for critical vulnerabilities in research software within 24 hours of detection. This centralized patching removes the burden from individual PIs to act as IT security managers.

2. Protecting IP from Predatory Capital

The government can strengthen security by addressing "backdoor" threats—where foreign entities gain control of sensitive technologies through investment rather than theft.

- **Venture Vigilance:** Integrating investment screening with research data to flag high-risk foreign capital targeting startups that originated from federal grants.

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[6] https://www.nationalacademies.org/publications/29241

- **IP Successor Protections:** Implementing "successor-in-interest" clauses in federal funding contracts. This ensures that if a company is sold or liquidated, critical IP cannot be transferred to non-allied foreign powers without federal review.

3. International "Trusted Research" Treaties

A major challenge is protecting discoveries without stifling the international collaboration that drives science.

- **New Model:** We propose negotiating Research Security Treaties with key allies (e.g., G7, Five Eyes). Signatories would agree to a unified security standard, creating a "Trusted Research Circle."
- **Frictionless Collaboration:** Collaboration among signatory nations would be "fast-tracked" with reduced vetting, while collaboration with non-signatories would undergo enhanced scrutiny. This preserves open science within a secure perimeter.