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CUT TO INVEST

Create a Nationwide Network of Advanced Industries Innovation Hubs

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Summary

Congress should authorize the build-out of a national network of advanced industries (AI) innovation hubs, expanding on the modest beginnings now being made through the Department of Energy's Energy Innovation Hubs program and the Department of Commerce's National Network for Manufacturing Innovation (NNMI) initiative. Functioning as regional centers of excellence, the new hubs would focus on cross-cutting innovation and technology deployment challenges of critical interest to advanced industries by drawing universities, community colleges, state and local governments, and other actors into strong industry-led partnerships. The creation and appropriate funding of at least 25 such hubs would greatly accelerate the pace of innovation and new-product development in the nation's advanced industries and so strengthen their long-term competitiveness.

Background

In the aftermath of the Great Recession, the United States needs to transition from an economic model focused on finance and consumption toward a "next economy" model oriented toward innovation, engineering, and production. Such a model promises to increase the nation's productivity, drive export growth, and provide good-paying jobs.

Advanced industries—characterized by dynamic R&D and engineering-intensive industrial concerns—must be a focal point of this new direction. Delivering products and services in industries ranging from aerospace and space to auto assembly, advanced energy systems, IT, and medical devices, AIs comprise over 10 percent of the overall economy, generate 45 percent of U.S. goods exports, and support over 4 million high-skilled, and several million more ancillary, jobs.

Nor is that all. A prime site of R&D activity in the U.S. economy, AIs punch well above their weight in building and expanding national and regional economic competitiveness. Innovations in AIs—such as photonics technology with applications in optical communications, medical diagnostics, semiconductors, optical imaging, and the now ubiquitous GPS technology—tend to ripple across the economy and drive broader productivity. As a result, AIs contribute inordinately to the competiveness of the nation's critical traded sectors, which will be crucial in helping the United States to balance its foreign trade.

Simply put, the U.S. economy will not regain its full vitality and preeminence without a strong push to extend the leadership of AIs.

The Problem

Though there now exists increased recognition of the need to stoke innovation in AIs through the establishment of highly focused applied research centers, changing business realities and mainstream intellectual assumptions have precluded an adequate response to the challenge.

To be sure, the United States has an illustrious history of bridging the gap between (often academic) basic science and commercial technology roll-out through purpose-built, highly applied research centers like Bell Labs (which developed the transistor), MIT's Lincoln Laboratory (which developed radar), and IBM's Watson Research Center (which advanced state-of-the-art scientific computing). Such privately funded hubs acted as crucial incubators for game-changing new technologies in numerous industries and so kept their companies—and the nation—ahead of the world by taking a deliberate and focused approach to high-risk, high-reward research.

Unfortunately, though, neither the private nor the public sectors have been able to sustain the needed applied research enterprise.

On the industry side, the current corporate financial environment—with its emphasis on shorter-term rates of return—has served to depress investments in R&D and innovation. Private markets, in this respect, frequently fail to generate sufficient investments in energy innovation when its benefits are poorly known and risks may be high.

On the public side of the matter, the default position in Congress assumes—erroneously—that new technologies emerge automatically from advances in science and have the capability to commercialize themselves in the marketplace. However, this ignores fundamental market failures that lead the private sector to invest significantly less in basic science and new technology than is socially desirable. As a result, the federal government has invested in R&D neither in sufficient scale nor in the most optimal applied, collaborative formats.

Along these lines, a number of problems afflict the applied research enterprise in America's AI sector:

- Private firms lack the incentives to invest sufficient amounts in early-stage and applied research or in technologies that are broadly applicable across several industries. Most private innovation spending flows to "development" research that tends to be incremental in nature rather than transformative. Among the realities that depress investment are: knowledge spillover risks; the long time horizon of projects; the enormous up-front costs
- Federal investment in industrial research has been uneven and insufficient for years. From 1987 to 2008, federal R&D investment grew at a mere 0.3 percent per year in constant dollars—a rate significantly slower than the average annual growth rate of 4.9 percent from 1953 to 1987 and 10 times lower than the rate of GDP growth. Investment in the energy sector is indicative of this shortfall. According to the Information Technology & Innovation Foundation's Energy Innovation Tracker, the United States is investing approximately $6 billion in clean energy R&D in FY 2012—an amount substantially lower than the $15 billion per year target that leading energy experts, including those at the Brookings Institution, have called for based on the R&D intensity of other comparable AIs
- Other nations, meanwhile, are investing more as a share of GDP in R&D compared to the United States, raising serious questions about the nation's ability to maintain its AIs lead in the coming years. For example, while U.S. R&D intensity increased by a modest 10.4 percent between 1995 to 2008, it increased by 20.5 percent in Germany, 42.2 percent in Korea, 135.1 percent in Singapore, and a staggering 170.2 percent in China
- Finally, the character and format of federal R&D have been suboptimal, with much U.S. research conducted within an academic, "basic science" context or in siloed national labs, isolated from the private sector and its market realities. Much more work is needed that would solve more

generic or cross-cutting problems associated with the deployment of critical technologies for groups of firms

In terms of recent policymaking, it bears noting that the nation has begun to recognize these problems and respond to them. However, the scale and pace of its experimentation has been too small and too slow. On the energy side, while the DOE requested financing for eight Energy Innovation Hubs in FY 2010 budget, only five centers—focused on energy efficient buildings, nuclear modeling and simulation, fuels from sunlight, critical materials, and batteries and energy storage—have been authorized to date. As to the broad realm of advanced manufacturing, only one pilot institute has been created so far as part of the NNMI initiative, with action pending in Congress to implement this important proposal that will revitalize advanced manufacturing.

The bottom line: The United States needs to significantly increase the scale of the applied innovation activities in advanced industries while at the same time ensuring that the format in which these resources are invested provides the maximum commercial impact and economic return for the nation.

Proposal

Given these challenges, the Metropolitan Policy Program at Brookings proposes that **Congress authorize the build-out of a national network of advanced industries innovation hubs by funding at least five more Energy Innovation Hubs and supporting the creation—with stable funding—of at least 20 institutes for advanced manufacturing innovation as proposed in the NNMI initiative.** Such a build-out could at once scale-up two existing programs while packaging them appropriately as a single transformational initiative for renewing the U.S. economy.

Concentrating innovation resources into a network of purpose-designed, collaboration-based regional applied research centers focused on industry-relevant product and process issues holds out great promise for accelerating technology advances and subsequent market-share growth in crucial U.S. industries.

Such centers will tackle the toughest problems with the biggest commercial pay-offs in technology and process development, technology deployment, and platform establishment. Because they will be regional and intensely collaborative, with strong private-sector participation, the hubs will produce substantial economic spillovers into the regional advanced industry clusters amid which they will be sited.

Form will follow function, moreover. To ensure the hubs foment intense collaborative activity, federal cost-shared funding will be allocated by means of competitive solicitations that stipulate extensive industry, state, and academic participation. To ensure the collaborations remain commercially relevant, federal support will be contingent on co-investment by businesses and other non-federal entities. Progress toward sustainable operations will be stipulated from the start and hubs must become financially sustainable within seven years.

Finally, in order to ensure a robust attack on important problems and real results, each hub will require annual funding of $25 million for a period of at least five years. Possible themes for the new hubs could include carbon capture and storage, solar photovoltaics, and smart grid on the energy side and advanced materials, nanomanufacturing, and industrial robotics on the advanced manufacturing and engineering side. Funding would be contingent after five years on demonstrated progress and results and each hub would move toward self-sufficiency. No criteria for success would matter more than industry willingness to partner and invest.

Along these lines, the creation of 25 advanced industries innovation hubs combined with stable funding for all would:

- **Send a strong signal** that the United States remains fiercely committed to investing in game changing breakthroughs and cultivating a vibrant innovation ecosystem
- **Accelerate the pace** of applied research in advanced industries
- **Drive down the cost** of advanced industries technologies and accelerate their deployment
- **Contribute to workforce development** not just at the Ph.D. level but at all levels
- **Spawn new, good-paying jobs and industries** and aid the nation's recovery through its huge employment multiplier effects
- **Boost exports and enable the United States to compete effectively** in global markets, which in turn will ensure a vibrant national economy

As these positive effects suggest, the creation of these innovation hubs, when paired with the provision of stable funding for all, would work to bolster the nation's innovation capacity and strengthen its global leadership position in advanced technology-oriented industries.

Budget Implications

If authorized by Congress, the funding of 25 AI innovation hubs at a budget level of $25 million per hub per year would cost $625 million annually for a period of five years. The hubs could be supported out of the discretionary budget, through the regular appropriations process, or, alternatively, they could be paid for through repatriated tax cuts on offshore funds, combining public-private sources of capital, and wires tax.

State of Play

Broad support exists for creating the next three as-yet unfunded Energy Innovation Hubs as well as for launching a National Network for Manufacturing Innovation. Support for congressional authorization of the energy hubs comes from many leading energy experts in the nation, who view the hubs as a way to catalyze and drive innovation and technology development in priority energy areas. The American Energy Innovation Council, the President's Council of Advisors on Science and Technology (PCAST), the Center for American Progress (CAP), the Breakthrough Institute (BTI), and the Information Technology & Innovation Foundation (ITIF) have called for the establishment with appropriate funding of all proposed energy hubs.

PCAST also recommended that the United States launch an advanced manufacturing initiative "to support academia and industry on applied research on new technologies and design methodologies through precompetitive consortia that tackle major cross-cutting challenges." The administration's proposal of 15 centers for manufacturing innovation has been welcomed by the ITIF, CAP, the National Association of Manufacturers, the Manufacturing Institute, and National Council for Advanced Manufacturing, and multiple university, engineering, and technology industry associations.

And yet, Congress has been slow and grudging in its support for both the energy and advanced manufacturing hubs concept. In FY 2010 Congress proved reluctant to fund all eight hubs on the grounds that the hubs appeared to duplicate other new programs at DOE such as the Energy Frontier Research Centers and the newly created Advanced Research Projects Agency—Energy (ARPA-E), both of which fund research that could transform energy technologies. Similarly, Congress has yet to act on the president's proposal to invest $1 billion to catalyze a national network of up to 15 manufacturing innovation institutes.

Implementation Requirements

Legislative action would be required to authorize the creation and funding of the AI innovation hubs, both on the energy and manufacturing sides. It is anticipated that while the banner agenda would associate the two initiatives, the hubs and manufacturing programs would remain distinct for legislative purposes, with each retaining its own committees of jurisdiction, rationales, and structure.

References

Advanced Manufacturing Portal, National Institute of Standards and Technology, "National Network for Manufacturing Institutes."

Robert Atkinson and others, "Strengthening Clean Energy Competitiveness: Opportunities for America Competes Reauthorization." Oakland and Washington: Breakthrough Institute, Information Technology & Innovation Foundation, and Brookings Institution, 2010.

Robert Atkinson and Howard Wial, "Boosting Productivity, Innovation, and Growth Through a National Innovation Foundation." Washington: Brookings Institution and Information Technology & Innovation Foundation, 2008.

Department of Energy, "Energy Innovation Hubs."

James Duderstadt, "Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research, and Education." Ann Arbor: The Millennium Project, University of Michigan, 2008.

James Duderstadt and Mark Muro, "Hubs of Transformation: Leveraging the Great Lakes Research Complex for Energy Innovation." Washington: Brookings Institution, 2010.

James Duderstadt and others, "Energy Discovery-Innovation Institutes: A Step Toward America's Energy Sustainability." Washington: Brookings Institution, 2009.

President's Council of Advisors on Science and Technology, "Report to the President on Capturing Domestic Competitive Advantage in Advanced Manufacturing." Washington: The White House, 2012.

Stephen Ezell and Robert Atkinson, "Fifty Ways to Leave Your Competitiveness Woes Behind: A National Traded Sector Competitiveness Strategy." Washington: Information Technology & Innovation Foundation, 2012.

Stephen Ezell and Robert Atkinson, "The Case for a National Manufacturing Strategy." Washington: Information Technology & Innovation Foundation, 2011.

David M. Hart, Stephen Ezell, and Robert Atkinson, "Why America Needs a National Network for Manufacturing Innovation." Washington: Information Technology & Innovation Foundation, 2012.

Mark Muro and Jessica Lee, "Hubs of Manufacturing: Let's Get Started." *UpFront*, 2012.

John F. Sargent, "The Obama Administration's Proposal to Establish a National Network for Manufacturing Innovation." Washington: Congressional Research Service, 2012.

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Remaking Federalism | Renewing the Economy

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