Boosting Productivity, Innovation, and Growth through a National Innovation Foundation

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To respond to America's slipping leadership in commercial innovation the federal government should establish a **National Innovation Foundation (NIF)**—a nimble, lean, and collaborative entity devoted to supporting firms and other organizations in their innovative activities.

By realigning and augmenting the nation's diffuse present efforts the new entity would help create better jobs in America, not just for highly educated "knowledge workers" but for high school graduates in manufacturing and "low-tech services."

America's Challenge

Action is essential. Innovation drives economic growth, determining America's living standards and those of its metropolitan areas. However, as global competition stiffens, the nation's leadership in innovation is under threat. For example, the United States' share of worldwide total domestic R&D spending fell from 46 percent in 1986 to 37 percent in 2003. Moreover, expanded support for basic research and science education, while important, will not be enough to respond to this challenge. Without a robust, targeted, and explicit federal innovation push, U.S. competitiveness will slip and economic growth will lag.

Limitations of Existing Federal Policy

America's current innovation policy efforts suffer from numerous shortcomings. They are underfunded and scattered throughout government. Federal policies do little to support effective state and local initiatives. And they pay little attention to the service sector and to the important roles that smaller firms and universities play in the commercialization process.

A New Federal Approach

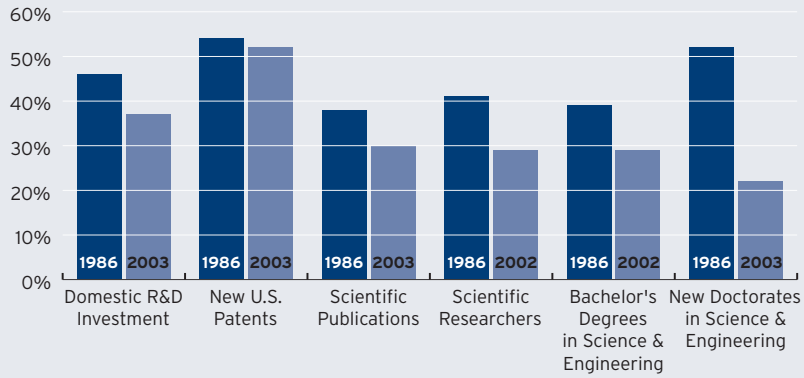
The federal government should therefore establish NIF with the sole mission of promoting innovation. The new entity, with a proposed annual budget of $1 billion to $2 billion, could exist within the National Institute of Standards and Technology, as a government-related public corporation, or as an independent federal agency like the National Science Foundation. NIF would:

- ***Catalyze industry-university research partnerships*** through national sector research grants to help promote innovation and commercialization
- ***Expand regional innovation-promotion*** through state-level grants to fund activities like technology commercialization and entrepreneurial support
- ***Encourage technology adoption*** by assisting small and mid-sized firms in implementing best-practice processes and organizational forms
- ***Support regional industry clusters*** with grants for cluster development
- ***Emphasize performance and accountability*** by measuring and researching innovation, productivity, and the value added to firms from NIF assistance
- ***Champion innovation*** by promoting innovation policy within the federal government and serving as an expert resource on innovation to other agencies

America's Challenge

Innovation—the creation and adoption of new products, services, technologies, and business models—drives economic growth. Improving America's standard of living depends on enhancing the nation's ability to innovate. In our global economy, however, America faces a growing innovation challenge.

The U.S. share in global totals on various science & technology indicators has slipped since the mid-1980s



Source: Council on Competitiveness, Competitiveness Index, 2007

America's economic well-being depends increasingly on its innovation prowess because more and more economic activity is subject to intense international competition. Low-wage nations can now more easily perform labor-intensive, difficult-to-automate work in manufacturing and in a growing share of services. Additionally, along with call centers and software production, American firms are also shifting their R&D overseas. In the last decade, the share of U.S. corporate R&D sites within the United States declined from 59 percent to 52 percent, while the share in China and India increased from 8 percent to 18 percent. For the United States to sharpen its competitive edge in the future, the nation must place greater emphasis on the most highly innovation-based activities for which location decisions depend less on lower costs abroad. It must also innovate to raise productivity, particularly in activities in which it competes with other nations, so that higher U.S. wages are not a bar to cost-competitiveness.

However, America's innovation leadership is slipping at a time when innovation is increasingly important. Other high-wage nations have ramped up their innovation investments to such an extent that, since the mid-1980s, the U.S. share of worldwide totals has dropped for domestic R&D spending, new U.S. patents, scientific publications and researchers, and bachelor's and new doctoral degrees in science and engineering. The United States ranks only seventh among countries in the Organization for Economic Cooperation and Development (OECD) in the percentage of its GDP that is devoted to R&D expenditures (2.6 percent). Sweden, Finland, Japan, and South Korea all rank ahead, spending at least 3 percent of their respective GDPs on R&D. Furthermore, the United States ranks only 14th among countries for which the National Science Foundation (NSF) tracks the number of science and engineering articles per million inhabitants. And, while American graduate degrees in non-science and non-engineering fields increased by 64 percent between 1985 and 2002, the number in science, technology, engineering, and mathematics grew by only 14 percent during the same period.

Private markets within the United States are likely to produce less innovative output than the nation requires. Because individual firms cannot capture all the benefits of their own innovative activity, firms will generate less innovation than society needs. Similarly, the reality of spillover benefits means that individual firms may not contribute sufficiently to geographic industry clusters, which can help propel the creation and diffusion of innovation. In addition, many industries and firms lag in adopting technologies proven to be more productive. This is especially true for small- and medium-sized businesses outside of cutting-edge science- and technology-based industries.

The U.S. share of worldwide domestic research and development investment declined from 46 percent in 1986 to 37 percent in 2003.

Even the largest firms may have difficulty in investing in innovation-related activities on their own. In the face of short-term competitive pressures, they are relying more on universities and industry-university collaborations for their basic and applied research needs. However, the research agendas of different organizations may not always intersect. Universities are not necessarily motivated to work on commercial needs, and businesses may want to appropriate university discoveries for themselves, thereby impeding the free flow of innovative knowledge throughout the economy.

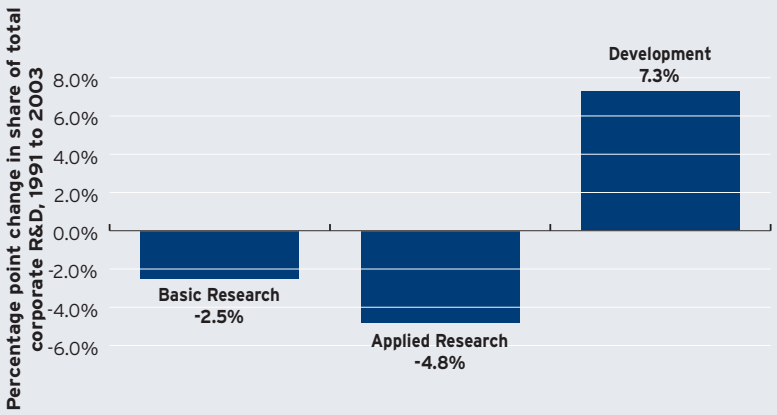
Private financing of R&D in the United States has shifted away from more entrepreneurial and early-stage research efforts, perhaps as a result of decisionmakers' shorter time horizons. First, as the venture capital market has matured, venture capitalists have found it more profitable to invest in larger deals and less risky later-stage deals at the expense of smaller, riskier, early-stage efforts in basic and applied research. Second, corporate-funded R&D focuses less on generic technology research and more on development-related activities. Between 1991 and 2003, the shares of corporate R&D devoted to basic and applied research fell by 2.5 and 4.8 percentage points, respectively, while development's share increased by 7.3 percentage points.

Limitations of Existing Federal Policy

America's innovation challenge—growing global competition and market limitations of innovation-related activities—demands government engagement to improve the innovation process. Unfortunately, the nation's current innovation-related programs, administered out of traditionally isolated federal bureaucracies, fail to catalyze private sector actors effectively in strengthening the nation's market environment for innovation. Several problems require attention:

The United States has no explicit national innovation policy. The United States has a basic science policy (funding research and educating scientists and engineers) but has no specific productivity and innovation policy focused on firms and other organizations. Moreover, federal innovation programs that do exist operate in an ad hoc manner rather than as part of a general policy to promote innovation.

Basic research and applied research have declined as shares of corporate R&D



Federal innovation efforts are fragmented and diffuse. Although a number of federal programs help companies become more innovative or productive, there is no federally-funded organization whose sole mission is to spur innovation. At best, federal programs treat innovation as a byproduct of other goals or deal with limited aspects of the problem, such as university technology transfer or performance improvement in manufacturing. Furthermore, most federal innovation-related programs are designed to help individual firms, not to promote innovation across firms as well as within them. As a result of these shortcomings, the federal government fails to connect different kinds of innovation, the various stages of the innovation process, and the innovation needs of diverse industries and geographic regions.

Federal innovation efforts are underfunded. The federal government invests little compared to other nations in innovation-promotion activities. Those programs that focus most directly on such efforts have seen their budgets decline or grow more slowly than the economy overall. In fiscal year 2006, the federal government invested a total of $2.7 billion, or 0.02 percent of GDP, in its principal innovation programs and agencies. By contrast, Sweden spent 0.07 percent of its GDP, Japan 0.04 percent, and South Korea 0.03 percent. If the U.S. wanted to match Finland's innovation outlays per dollar of GDP it would have to invest $34 billion per year, more than ten times what it spends now.

Federal innovation efforts are focused on larger firms and a few major research universities and less on the process of commercialization, which requires public and private entities of all sizes. Historically, the federal innovation system has focused on larger firms and a few major research universities, but the innovation needs of the U.S. economy today extend well beyond these few institutions. The nation cannot rely on other firms to simply copy or adapt the innovations that emerge from large firms and universities. Rather, the process of innovation commercialization requires public and private entities of all sizes from the outset. Although there are too many small- and mid-sized firms and colleges and universities for the federal government itself to engage meaningfully with all of them, federal policies can better support state-level efforts to strengthen these entities and the collaborations between them.

Federal policies give little attention to services innovation. U.S. innovation policy focuses largely on innovation in goods-producing industries, which may involve developing a new energy source or com-

ing up with new materials. Since service industries account for the vast majority of U.S. output and employment, we must place more emphasis on services innovation. The application of scientific rigor to the practices of service firms would lead to more efficient delivery of standardized services, better interpretation of customer needs, and improved performance in non-routine problem-solving.

Most federal programs do not coordinate or collaborate with innovation-policy efforts by state or local governments or regional organizations. The federal government is often far removed from the firms and institutions that drive innovation. In contrast, state and local governments and regional organizations are usually more closely tied to production processes and have long track records of working more closely and flexibly with firms, including small- and mid-sized businesses. In fact, since the 1980s, when the U.S. first began to face global competitiveness challenges, all states and many local governments and metropolitan business alliances have established technology-based economic development (TBED) programs and now invest about $1.9 billion per year on these activities.

Many advanced nations have realized that if they are to prosper in the highly competitive, technology-driven world economy, they need to go beyond their historical investments in basic research, universities, and national laboratories.

While existing state and regional TBED efforts are impressive, state and local governments and metropolitan-level organizations could do even more. One reason they do not do so is that, like firms, it is difficult for them to capture all the benefits of TBED activities. Some of the benefits flow to universities, firms, and customers in other states. Moreover, the benefits can take a relatively long time to come to fruition, often during the terms of subsequently elected officials. For these reasons, states invest less in TBED than the needs of the nation require. Federal incentives are needed to help them do more.

Unfortunately, federal decisionmakers largely ignore their sub-national counterparts, stifling regional policy innovations rather than bolstering them. The NSF, for example, has a long history of making investments in research centers with little consideration for existing state science and technology policies. Few federal programs recognize the key role that geographic industry clusters play in creating and diffusing innovation. A more supportive federal engagement could help states coordinate their TBED activities across state lines, give them information on successful and unsuccessful practices, and encourage them to implement smart region-specific innovation strategies. The federal government could also engage directly with regional industry clusters, supporting their firms, educational institutions, business alliances, and other regional institutions in providing the training, technological modernization, and other forms of assistance that cluster firms need if they are to innovate, but that the firms cannot provide on their own.

In sum, the federal status quo is out of sync with the innovation needs and economic realities of the 21st century American economy.

A New Federal Approach

In recent years, many advanced nations have realized that if they are to prosper in the highly competitive, technology-driven world economy, they need to go beyond their historical investments in basic research, universities, and national laboratories. To that end, these nations—our competitors—are specifically promoting innovation through the establishment of relatively new, sophisticated, well-funded, and stand-alone technology- and innovation-promotion agencies. It is time for the United States to do the same.

The federal government should create a National Innovation Foundation (NIF) to address America's innovation needs. NIF would aim to help firms in the non-farm economy become more innovative and competitive by conducting a series of essential activities. NIF would:

- **Catalyze industry-university research partnerships through national sector research grants.** NIF would offer competitive grants to national industry consortia for sector-specific research at universities and other research institutions. This activity would catalyze collaborative research via industry-university alliances and bridge the gap between basic research and the introduction of new products and processes. For firms to be eligible for these grants, they would need to form industry-led research consortia of at least five firms that can chart out their common mid-range technology needs and provide a minimum of one-to-one matching of federal funds. Firms receiving national sector research grants or benefiting from the state-level grants described below would be required to perform NIF-supported R&D in the United States and promote the production of any resulting goods or services in the United States, and the likelihood that R&D will ultimately lead to production in

A Model Innovation Agency: Finland's Tekes

In the last two decades Finland has experienced a miraculous transformation from an economy largely dependent on natural resources to a world leader in technology. Although the growth of Nokia, the world's leading mobile phone manufacturer, is a large part of the Finnish success story, another contributing factor is Tekes, Finland's national innovation agency.

Tekes plays a major role in the Finnish innovation system. Affiliated with the Ministry of Trade and Industry, Tekes has its own governing board with representatives from national and regional government, businesses, and unions. With a budget of $560 million and a staff of 300, Tekes funds many research projects in companies, multi-firm partnerships, and business-university partnerships.

Working with business and academia, Tekes has identified key technology and application areas on which to focus its resources. The range includes nano-sensors, broadband, and services innovation. In addition to funding research projects, Tekes facilitates networking and collaboration by convening forums of the key stakeholders for each of its focus areas. Tekes also publishes descriptions of the projects it funds. Through these processes, researchers learn more about technology challenges and areas of need, and they gain opportunities to collaborate.

Tekes also conducts foreign outreach efforts to help domestic companies partner with foreign businesses or researchers. It operates a number of overseas technology liaison offices, including ones in Washington, DC; Singapore; and South Korea. Indeed, 40 percent of Tekes-funded projects involve international collaboration.

the United States would be one factor in all NIF R&D award decisions. NIF and/or Congress should develop additional criteria for these awards, which could include potential to address critical national needs, generate substantial benefits to the nation as a whole, and contribute to the nation's science and technology knowledge base. Grant proposals would be reviewed by rotating technology-specific panels staffed with experts from biotechnology, photonics, manufacturing, and other fields.

- **Expand regional innovation-promotion through state-level grants to fund activities like technology commercialization and entrepreneurial support.** NIF would help states expand their TBED and other innovation-promotion efforts. Innovation-based economic development (IBED) grants would fund activities such as technology commercialization, entrepreneurial support, and regional skills alliances. Grant proposals would need to be grounded in their regions' economic realities, serve the national as well as state interest, and be supported by two-to-one matching of federal funds. Where relevant, state proposals would also be judged on their plans for generating interstate collaboration and innovation alliances between localities, businesses, and educational and other institutions. Rotating panels of experts would provide initial feedback to states on improving their applications before accepting final submissions, according to which the awards would be allocated. However, all states that met the basic procedural and state funding requirements would receive some NIF funding for IBED.

NIF would aim to help firms in the non-farm economy become more innovative and competitive by conducting a series of essential activities.

- **Encourage technology adoption by assisting small and mid-sized firms in implementing best-practice processes and organizational forms that they do not currently use.** NIF would focus on the diffusion of existing processes and organizational forms to businesses that do not currently use them. States would submit proposals to NIF for matching funding to operate one or more technology diffusion centers within their borders. Like the existing Manufacturing Extension Partnership Program (MEP) overseen by the Commerce Department, this NIF activity would focus primarily on small and mid-sized firms. Unlike MEP, however, NIF centers would help both manufacturing and service-oriented firms implement waste-reducing, quality-enhancing lean production techniques in their business operations, here applicable. NIF would also develop practical methods for raising the productivity of non-standardized processes to which lean production techniques would not be suitable.

- **Support regional industry clusters with grants for cluster development.** NIF would empower regional industry clusters to enhance their capacity to address innovation- and productivity-related problems that are better solved across an industry cluster than firm by firm. To spur the development of regional cluster consortia, NIF would offer competitive, multi-year grants of varying amounts to cluster initiatives to support activities such as regional marketing and trade missions, joint purchasing, and technological modernization. Further details on this program are available in a companion paper in the *Blueprint for American Prosperity* series, "Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies."

- **Emphasize performance and accountability by measuring and researching innovation, productivity, and the value-added to firms from NIF assistance.** NIF would help improve the measurement of innovation and carry out a program of research on innovation. These efforts would allow NIF to guide and evaluate its own work and provide firms and government agencies with the information they need to promote innovation. To conduct these activities, NIF would partner with the major federal statistical agencies and the NSF, giving them financial support to conduct relevant surveys. Specifically, NIF would work with these other federal entities to create better metropolitan-level measures of productivity, patents, public and private benefits of R&D, and product and process innovations adopted by firms. It would also evaluate the results of NIF-provided assistance.

- **Champion innovation by promoting innovation policy within the federal government and serving as an expert resource on innovation to other agencies.** NIF would be the federal government's major advocate for innovation and innovation policy. It would produce an annual Innovation Report (akin to the Economic Report of the President). Additionally, NIF's expertise in innovation would also make it a key source of assistance to federal innovation programs in other parts of the federal government (e.g., in the Agriculture and Energy Departments).

NIF would not be an additional layer of government that duplicated the functions of existing federal agencies. It would incorporate or replace several existing or former programs—three NSF commercial innovation programs; the Workforce Innovations in Regional Economic Development program in the Labor Department; and the Technology Innovation Program (TIP), MEP, and the former Office of Technology Policy in the Commerce Department—while expanding on or adding to their activities. NIF would have a staff of about 250 professionals, about the size of the programs NIF would replace. NIF would coordinate with but would not incorporate, replace, or duplicate the roles of the major science programs in the federal government, such as the National Institutes of Health, existing agriculture- or energy-specific innovation programs, or the basic science programs of NSF.

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The federal government has several options available for funding and organizing NIF. In terms of financing, the necessary funds—initially $1 billion per year and growing to $2 billion after several years—could come from a variety of sources. Some of these funds could come from the budgets of existing federal innovation-promotion programs that the new entity would incorporate or replace. Other monies could be raised by eliminating wasteful oil and gas subsidies. Finally, some funds could come from general revenue. NIF would even warrant deficit financing because it would be an investment whose benefit to the U.S. economy would occur in the future (rather than a consumption item whose benefit is exhausted in the same year that the spending occurs). Even if the entire $1 billion needed to fund NIF initially were obtained from general revenues, this would amount to less than 0.0004 percent of total federal outlays in 2006. At $2 billion, NIF's budget would be about one-third the size of NSF's.

In terms of organization, NIF needs a structure that allows it to be nimble, lean, and collaborative. It must be able to understand firm-level needs, hire quality staff, have close links with stakeholders, and be accountable for results. Three different organizational options are possible:

- **Commerce Department option.** Within the Commerce Department, NIF could be housed with the National Institute of Standards and Technology (NIST), possibly with a separate advisory board to give it more autonomy. Because NIST is where TIP and MEP are currently located, this option allows NIF to build on their considerable expertise in understanding and responding to changing business needs and in program evaluation. At the same time, there is the risk that within NIST, an expanded innovation role would not receive the attention it deserves and that NIF would suffer from the same under-funding and neglect that plague TIP and MEP.

NIF is neither a centrally-directed industrial policy nor a "corporate welfare handout." Rather it is a strategy to help America remain the world's innovation leader in the 21st century.

- **Public-sponsored corporation option.** As a new government-related public corporation, NIF could be structured along the lines of the Corporation for Public Broadcasting. The advantage of this option is that it would give NIF the maximum amount of flexibility and agility to interact effectively with business and states. It would also be possible for Congress to advance-fund NIF for one year beyond the fiscal year for which it funds government agencies, giving it added financial stability and more leeway to develop long-range plans.

- **Independent federal agency option.** NIF could also be established as an independent government agency, akin to the Export-Import Bank or the Overseas Private Investment Corporation. Both are modestly sized, have boards of directors from the private sector, work extensively with the private sector, and hire more quickly and pay higher salaries than traditional government agencies. NSF is another example of an independent government agency sharing some of these features. Indeed, the similarity between NSF's and NIF's needs in staffing, evaluation and measurement, and grantmaking may make the independent agency model especially suitable.

The proposed National Innovation Foundation is neither a centrally directed industrial policy nor a "corporate welfare handout." Rather, it is a new initiative to promote innovation. Responding to the growing global competition for innovative activities, individual firms, state governments, and business and university alliances are already working to spur innovation. NIF would help give them the resources and the business and technology expertise they need to make those efforts even more effective. In this way, America can combine its world-class market environment with a world-class public policy environment and remain the world's innovation leader in the 21st century.

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ITIF is a non-partisan research and educational institute—a think tank—whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington, and in the states. Recognizing the vital role of technology in ensuring American prosperity, ITIF focuses on innovation, productivity, and digital economy issues. Learn more at **www.itif.org**

For More Information

The full-length paper from which this brief is drawn is available at **www.blueprintprosperity.org** and at **www.itif.org**

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