Information Technology and Innovation Foundation

Comments to Notice of Request for Information on:

The Strategy for American Innovation

September 23, 2014

The Information Technology and Innovation Foundation commends the Administration for seeking public comment as it begins to articulate the second *Strategy for American Innovation (SAI).* A successful strategy for American innovation must promote both technological-based and non-technological-based (i.e. institutional and organizational) innovation throughout all layers and parties in an economy, including the private sector, government agencies, and non-profit organizations. In other words, the strategy should not only address innovation in government; rather, its chief aim should be to fundamentally change private sector activity and behaviors to spur greater levels of innovation.

Q1: *What specific policies or initiatives should the Administration prioritize in the next SAI?*

As part of the next *SAI*, the Administration should direct each federal agency to develop its own specific innovation strategy/agenda in which each agency takes the lead in undertaking a study evaluating how it can spur greater levels of innovation in the economic sectors they touch, including an assessment of how regulatory policy/regulations may preclude or limit innovation in each sector. The core challenge is that federal agencies currently work to advance their own particular missions and have not been charged with coordinating with other agencies or taking into account the impact of their actions on America's innovation competitiveness. Take medical devices: the Food and Drug Administration (FDA) reviews the safety and effectiveness of medical devices, the Department of Health and Human Services (HHS) sets reimbursement schedules, and the Department of Defense (DoD) and the Veteran's Administration (VA) procure such devices. But there is little or no coordination across agencies to develop a unified strategy that would orient government policies to support the competitiveness of the U.S. medical device industry. To address this, the *SAI* should task each agency with developing strategic roadmaps and guide inter-departmental collaboration to ensure that the regulatory policies and activities of disparate government agencies, are, wherever possible, aligned to promote the global competitiveness and productive capacity of strategic sectors of the U.S. economy.[i] Furthermore, each agency should analyze how to improve productivity in key services sectors (i.e., construction, higher education, transportation, health, finance, etc.). Thus, the Department of Transportation (DoT) would lead in spurring the national deployment of intelligent transportation systems; HHS in health IT; the Federal Communications Commission (FCC) in mobile payments, etc.

Pursuant to this, each federal agency should create an innovation fund (of at least 3 percent of the agency's budget) for pilot programs seeking to identify innovative ways of using technology to drive high-impact, transformational change. For instance, DoT should repurpose money away from concrete to cost-effective solutions that increase mobility, such as computerized adaptive traffic signal lights and parking meters, real-time traffic information, and intelligent vehicles and infrastructure. Further here, each agency should develop an Internet of Things (IOT) strategy (e.g. HHS examines how to use IOT in the housing system, DoE and FERC in the utilities sector, etc.). It should be institutionalized as part of each agency's charter that driving innovation across the economy and society is part of its core mission and agencies should be charged with authoring an innovation strategy every five years.

Q2: ***What are the biggest challenges to and opportunities for innovation in the United States?***

The biggest challenges are underinvestment in research and development (R&D) and innovation, the erosion of America's industrial commons, and an increasingly mercantilist global trade system that threatens America's innovative industries.[ii] Federal R&D plays a key role in driving U.S. innovation, productivity, and overall economic growth, but the federal government's investment in R&D has faltered both in historical terms and relative to competitors.[iii] In fact, to restore federal support for research as a share of GDP to 1987 levels, America would have to increase federal support for R&D by almost $110 billion—per year.[iv] If current trends hold, Battelle estimates that China will surpass America in federal investment in R&D within a decade.[v] The impact of declining federal investment has been felt particularly in the life sciences sector, where funding for the National Institutes of Health (NIH) has declined by 22 percent in real terms since 2003.[vi]

Yet the private sector is also to blame for underinvestment in R&D. As ITIF writes in *Innovation Economics*, the United States has been the only leading industrial economy over the past two decades in which companies overwhelmingly shifted their research portfolios from basic and applied R&D to development. In fact, from 1991 to 2008, basic research as a share of corporate R&D conducted in the United States fell by 3.6 percent, while applied research fell by roughly the same amount, 3.5 percent. In contrast, development's share increased by 7.1 percent.[vii] This corporate short-termism is also evident in underinvestment in workforce development training (which has been cut by U.S. enterprises 38 percent over the past decade) and as business investment in capital goods such as equipment, software and structures grew just 0.5 percent annually in the 2000s, a fraction of growth in previous decades.[viii] This sustained underinvestment and short-termism have led to serious erosion in America's industrial commons that has left us unable to manufacture a range of advanced high-technology products from fabless semiconductor chips to LCD screens and lithium polymer batteries.[ix]

To tackle this short-termism, the Administration should organize a Commission on Short-termism in U.S. Capitalism, a joint task force bringing together Treasury, the Securities and Exchange Commission (SEC), the Department of Commerce, the National Economic Council, OSTP, and other agencies to better identify the sources and causes of risk aversion and short-termism in America's financial capital markets. The Commission would also include CEOs, innovation gurus, and capital market experts, etc., and ask questions such as how to get American enterprises to invest more in R&D, capital equipment, workforce training, and to take a longer term time horizon. As part of this, the SEC should think about crafting a reform agenda for a corporate governance structure that will help better drive long-term, breakthrough investments in innovation. A White House summit on this topic could be framed as a pro-growth collaboration with American industry.

America's greatest opportunities in innovation are in sectors such as advanced manufacturing, robotics, life sciences, aerospace, information and communications technology (ICT) manufacturing, and Internet and digital services. An increasing challenge, however, is designing a regulatory environment in which innovation in these sectors can flourish.

Q4: *How can the federal government augment its capacity for innovation and competitiveness analysis?*

Ideally, the Administration should create a new traded sector analysis unit within the federal government. The entity, which might be positioned within the National Institute of Standards and Technology (NIST) Innovation and Industry Services division, would regularly assess important aspects of overall U.S. traded sector competitiveness (e.g., trends in FDI, growth of traded sector jobs and output, changes in global market share of U.S. traded sectors, unfair foreign trade practices affecting these sectors, etc.). The entity would also coordinate, improve, and maximize the impact of the various federal agency innovation and productivity strategies described in Q1 above. The Administration should also increase funding for key federal statistical agencies assessing America's traded sector competitiveness (and even contemplate creating a national statistical agency). Here, the Administration should look as a template to *The High-Tech Strategy of Germany*, which undertakes a comprehensive SWOT (strengths, weaknesses, opportunities, threats) analysis of Germany's major industries and platform technologies.[x]

Yet because all-too-often federal agencies propose regulations with little consideration given to their effect on innovation, the Administration should create within the Office of Management and Budget (OMB) an Office of Innovation Review (OIR) that would have the specific mission of being the "innovation champion" within agency rule-making processes.[xi] OIR would have authority to push agencies to either affirmatively promote innovation or achieve a particular regulatory objective in a

manner least damaging to innovation. OIR would be authorized both to propose new agency action and to respond to existing agency action. OIR could also incorporate a "competitiveness screen" in its review of federal regulations.

Q5: ***What innovation practices and policies have other countries adopted that deserve consideration in the United States?***

There are many, including applied R&D institutes, innovation vouchers, collaborative R&D tax credits, patent boxes, design assistance programs, and service innovation strategies. ITIF applauds the Administration's efforts to create a National Network for Manufacturing Innovation (NNMI) focused on promoting industrially relevant R&D and innovation in advanced manufacturing product and process technologies, but the United States now has four of these, compared to Germany's 69 Fraunhofer Institutes.[xii] Continued build-out of America's NNMI is needed.

At least a dozen nations have established collaborative R&D tax credits designed to incentivize industry investment in collaborative research, often including universities, enrolling multiple partners.[xiii] Accordingly, the Administration should push Congress to establish a 30 percent collaborative R&D tax credit for industry research undertaken in conjunction with universities, research institutes, national laboratories, or multi-firm consortia. But while R&D tax credits spur research, at least eight nations have adopted (and the United States should consider) tax incentives to spur the commercialization of that R&D through "patent boxes" that allow corporate income from the sale of patented products to be taxed at a lower rate than other income.[xiv] Most competitor nations have also sought to make their R&D tax credits more generous and expansive (such as Norway's extending R&D tax credits to services sectors and making it clear that process R&D qualifies for the R&D tax credit), while the U.S. R&D tax credit languishes and has fallen to just the world's 27th most generous.[xv]

Many countries seek to increase their R&D efficiency by using existing funding for scientific research to incent universities to focus more on technology commercialization. For example, in Sweden, 10 percent of regular research funds allocated by the national government to universities are now distributed using performance indicators. Finland also allocates 25 percent of the research and research training budgets of Finnish universities based on "quality and efficacy," including the quality of scientific and international publications and the university's ability to attract research investment from businesses.[xvi] Accordingly, the federal government should allocate a share of federal university R&D funding based on performance.[xvii] To make universities more accountable for results, the amount of industry-funded university research should be the first variable used to make allocation decisions, which could be achieved by requiring the inclusion of this factor in the evaluation of all National Science Foundation

(NSF) research grants. Further, to encourage the commercialization potential of federally funded research, all NSF-awarded private investigator grants should require the grantee to include at least a one-page description of the commercialization potential of the research being undertaken through the grant. The Administration should also create a knowledge bank (e.g., an online database) that makes all ideas generated from federally funded research publicly available to entrepreneurs and other researchers.

Several nations have introduced programs to help SME manufacturers understand the importance and role of design methods and principles.[xviii] For example, the UK's Designing Demand program is a mentoring and support service helps businesses make strategic design decisions and set up and manage design projects. Likewise, Ontario's Design Industry Advisory Committee (DIAC) has launched the Design Advisory Service, a design support program to help manufacturers and other growth-oriented SMEs improve their innovation outcomes.[xix] The United States should add a similar charge to the Manufacturing Extension Partnership (MEP) program and also launch an education and training program to help U.S. traded-sector services SMEs with services design and services innovation. Further to this, several countries, including Finland and Taiwan, have developed national services innovation strategies. The United States should undertake a Services Innovation research project that examines how ICT-based tools, functions, and platforms can promote innovation and productivity improvement in key services sectors and study what policies other nations have implemented to spur service innovation.

Q6: ***How has the nature of the innovation process changed?***

The modern innovation process is far more collaborative than ever before, explaining why two-thirds of R&D Magazine R&D 100-award winning innovations now stem from collaborative efforts (whereas in the 1970s most came from corporations acting on their own), demonstrating the importance of public policies that spur and incent collaborative industry-university R&D activities.[xx] Another major change has been the advent of rampant global innovation mercantilism, specifically competitor country policies such as localization barriers to trade that attempt to force the transfer of technology and/or intellectual property or location of productive activity (e.g., manufacturing) as a condition of market access. As ITIF writes in *Designing a Global Trading System to Maximize Innovation*, by introducing market balkanization, enabling excess competition, or compromising American intellectual property, innovation mercantilism constitutes a fundamental threat to the success of America's innovation-based industries.[xxi] As such, trade policy—including both trade enforcement and market opening initiatives—must be viewed as a key enabler of American innovation, particularly in the traded sectors of America's economy.[xxii]

Q7: ***What emerging areas of scientific and technological innovation merit greater federal investment?***

The core strength of America's national innovation system has long been science-based innovation, whereas its core weakness has been engineering-based innovation. That approach worked well when few nations had the capacity to leverage U.S. scientific discoveries for their competitive advantage. But now U.S. federal R&D dollars for basic science generate knowledge that is essentially a non-rival, non-appropriable public good that can be quickly picked up and leveraged by foreign competitors. Today, competitors often rely on the basic research discoveries coming out of U.S. universities and national laboratories, which allows them to concentrate their efforts on turning U.S. scientific discoveries into their own innovative technologies and products which they sell to other nations. That's why science-based discoveries aren't sufficient anymore. The United States must also be able to make things here. And that requires engineering-based innovation, an appropriable activity through which U.S. establishments can add and capture value. And this requires the United States getting better at generating pathways that turn science into U.S.-made high-technology products.[xxiii]

Unfortunately, the United States invests significantly more in scientific research than it does in engineering. Of the total federal research investments in science and engineering in 2008, approximately 1/7th was allocated to engineering development and 6/7th to the various scientific fields.[xxiv] NSF invests roughly 1/10th the amount on engineering education as it does on science and mathematics education.

Therefore, it's time to raise the profile of engineering within our national innovation system, starting with significant increases in funding for NSF engineering activities, including raising funding for NSF's Industry/University Cooperative Research Centers (I/UCRCs) to at least $50 million per year while doubling Engineering Research Centers (ERC) funding to at least $110 million. But the Administration could go much further. But because NSF's primary mission is funding scientific research—not promoting engineering-based innovation—the Administration should request that Congress create a National Engineering and Innovation Foundation as a separate entity operating alongside NSF and fund it with $300 million annually.

More broadly, it's time to recognize that certain research programs NSF supports are much more important to our country's economic well-being and competitiveness than others and explicitly take this into account when making budgetary allocation decisions. Therefore, the Administration should look to reallocate NSF resources toward the kinds of science that has direct economic and industrial benefits for the United States. In particular, this means increasing NSF budgets for four key directorates: 1) math and physical sciences; 2) engineering; 3) computer and information sciences and engineering (CISE); and 4)

biological sciences, while permitting research budgets for the geosciences and social sciences to shrink.[xxv] Alongside this, the Administration should develop outcome-based innovation metrics assessing the effectiveness of federal research institutions (e.g., new companies created from research dollars) in addition to current output metrics (e.g., patents)

Q8: ***How can the federal government support institutional innovation?***

As noted in Q7, the United States needs new institutions to support innovation. This needs to occur across both the government, private, and educational sectors. The Administration should seek from Congress $50 million a year over the next five years, to be matched with funding from states and local school districts and industry, to invest in both the creation of new and the expansion of existing math and science high schools. The Administration could also offer planning grants for regions wishing to create alternative types of science, technology, engineering, and math (STEM) high schools or universities.

Another new type of institution needed are U.S. manufacturing universities that revamp their engineering programs to focus much more on manufacturing engineering and skills that is more relevant to industry. This would include more joint industry-university research projects, more student training that incorporates manufacturing experiences through co-ops or other programs, and a PhD education program focused on turning out more engineering graduates who work in industry.[xxvi] For inspiration, the Olin College of Engineering in Massachusetts is a good model for how the United States can transform its colleges into entrepreneurial factories while encouraging the development of completely new schools based on the needs of the current workforce.[xxvii]

U.S. federal agencies also need institutional innovation. Each agency should come up with the Top 5 institutional innovations they could undertake—for example, project-based learning and massively open online courses (MOOCs) at the Department of Education and public-private partnerships around ITS and tolling at the DoT. The Nuclear Regulatory Commission and America's network of National Laboratories are also sorely in need of institutional innovation.[xxviii] America could transform the National Labs into 21st century engines of innovation by adopting a flexible lab-management model that strengthens the labs' ability to address national needs and produce a consistent flow of innovative ideas and technologies. One component of this should be prioritizing the technology transfer activities of the National Laboratories, in part by adding more weight to technology transfer measures in DOE's National Laboratories Performance and Evaluation Measurement Plans.

Q9: ***What additional opportunities exist to develop high-impact platform technologies?***

A number of emerging technologies and manufacturing processes represent "platforms" for innovation that will touch innovation across all sectors of the economy. These should be the focus of elevated federal investment in basic and applied scientific research and the subject of public-private partnerships such as the Institutes for Manufacturing Excellence. Today's transformative platform technologies include: big data, (contactless) mobile payment systems, next-generation wireless technologies, driverless (autonomous) vehicles, quantum computing, cyber-physical systems, nanotechnology, additive manufacturing, adaptive materials, integrated computational materials, biomanufacturing, synthetic biology, genetic engineering, robotics, and renewable energy technologies.

Q10: ***What are the gaps in the federal government's science, technology, and innovation portfolios with respect to national challenges?***

The biggest current gap in America's innovation system revolves around more consistently bridging the gap to transform basic scientific discoveries into useful technologies and on into commercializable products that can be manufactured at scale in the United States. In other words, our gap pertains to other countries' industrial-oriented research and their manufacturing focus. For example, as a share of GDP, Germany invests seven times more than the United States into industrial production research. And while Germany has a strong science and research base, what it really excels at is applying that science base to engineering and manufacturing excellence.[xxix]

Part of the problem is that the current federal system for funding research pays too little attention to commercialization of technology, and is still based on the linear model of research that assumes that basic research gets easily translated into commercial activity. Accordingly, the Administration should propose creation of a Spurring Commercialization of Our Nation's Research program to support university, state, and federal laboratory technology commercialization initiatives. In particular, the Administration should promote creation of a set-aside program for federal agency budgets that invests 0.15 percent to a technology commercialization fund to fund university, federal laboratory, and state government technology commercialization. Section 8 of the draft Startup America Act 3.0 proposes this through an "Accelerating Commercialization of Taxpayer Funded Research," program, but the *SAI* should invest particular focus in promoting this concept and redoubled efforts to promote technology commercialization.[xxx]

Q12: ***What novel mechanisms or models might facilitate matching skilled STEM workers with employers?***

The Administration should work to increase credentialing for the manufacturing and the closely related logistics industry workforce members by expanding the use of standards-based, nationally portable, industry-recognized certifications specifically designed for a variety of manufacturing and industrial sectors, such as those developed by the Manufacturing Skill Standards Council (MSSC). In other words, we need to move toward a system of skills/capabilities (e.g., where employers could specify they need employees with a 7+ on computer science skills and they could feed that into a database that automatically matches skills needs with candidate's capabilities). To further this, the Secretaries of Labor and Education should ensure that industry-approved certification standards are established and available nationwide.[xxxi]

Q15: ***How to spur greater levels of entrepreneurship in the United States?***

Universities should define an entrepreneurial leave policy for undergraduate and graduate students in which students could retain full-time student status for one to two years while launching their own company. Likewise, universities should allow faculty members to suspend their tenure so that they may pursue commercialization opportunities. NSF should also collect better data regarding new business starts and spin-offs of new companies by faculty from universities. NSF could use this data to reward universities that do a better job; for example, by giving bonus points on research grant proposals they receive from private investigators at certain universities.

The Administration should reform the Small Business Innovation Research (SBIR) program, in part by reducing funding to "SBIR mills," accelerating the disbursement of funds, and allocating a greater share of SBIR investments toward translational stage research. The Administration should also reform the Small Business Investment Company (SBIC) program by devoting a greater share of funds (at least 25 percent) to smaller, riskier deals (perhaps less than $2 million), not just smaller companies.

Q18: What investments, strategies, or technological advancements are needed to restore the industrial commons?

The Administration should advocate for the creation of a unified Innovation and Investment Tax Credit (IITC) that provides a credit of 45 percent of expenditures in R&D and skills training above 75 percent of base-period expenditures and a credit of 25 percent on capital expenditures made in excess of 75 percent of their base-period expenditures.

The United Kingdom has recently set up "industry growth councils" for every major sector of its economy. For example, the Industry-Government Automotive Council was set up in 2009 to develop a strategic, continuous and collaborative conversation between government and the automotive industry in the UK. The councils develop industry technology roadmaps, undertake industrial supply chain mapping initiatives, and develop overseas networks for trade promotion.

Another idea would be to repurpose Fannie Mae into an industrial support organization, not a housing finance organization. The new Fannie Mae (perhaps called the Federal National Industrial Mortgage Association) would buy loans made to traded sector firms from banks and other lenders and sell them on the secondary market.[xxxii]

Q19: ***How can the federal government promote the creation of regional "innovation ecosystems?"***

The Economic Development Administration operates a regional innovation cluster program that identifies and supports regional innovation clusters, but EDA's efforts are underfunded. Federal efforts should focus on providing matching funding for regional and state technology commercialization, R&D, and workforce training programs. For instance, the Administration should champion Congressional passage of S. 4047, Senate legislation which would create a Federal Acceleration of State Technologies Deployment Program, or "FAST," a federal funding strategy for accelerating the local commercialization of newly developed technologies by matching cash-poor state programs.[xxxiii]

Q20: ***How should the federal government promote the creation of metropolitan "innovation districts"?***

The regional innovation hubs spurred by DoE through the stimulus were great case studies, but they need additional support to reach sustainable funding. One way to do this is to provide a regional commercialization angle to some R&D grants/Lab programs so that these entities are engaged more in the R&D phase of tech development. Further, as ITIF and Brookings write in *Going Local: Connecting the National Labs to their Regions for Innovation and Growth Task*, DoE should task the labs with a regional economic development mission, including opening the labs to small- and medium-sized businesses and increasing their relevance to regional and metropolitan clusters, for example by creating off-campus "microlabs" to provide a "front door" to the labs.[xxxiv]

Q24: ***What new areas should be identified as "national priorities"?***

On this question, the Administration should ask "what would be the top five to ten technologies that, if we could develop them, would have the greatest impact on U.S. productivity and standard of living?" Part of the answer would certainly include cures for Alzheimer's, other chronic diseases, and forms of

cancer. Recognizing that a 1 percent reduction in mortality from cancer would deliver roughly $500 billion in net present benefits, while a cure would deliver $50 trillion in present and future benefits, the Administration should insist that Congress maintain NIH funding at a level commensurate with at least one quarter of one percent (0.25 percent) of national GDP or higher.[xxxv] In the energy sector, this should include batteries; cheap, high-energy-conversion solar materials; drop-in, low-carbon fuels, and inexpensive methods for pulling carbon dioxide out of the atmosphere. Robotics and materials that last forever or that possess self-healing properties should also be treated as national priorities.

Still, productivity increases remain the principal way that economies grow. Accordingly, the United States should develop an American Productivity Commission modeled after Australia's Productivity Commission, whose mission is to promote productivity-enhancing public policies, initiate research on industry and productivity issues, hold public inquiries, and promote public understanding of matters related to industry and productivity.[xxxvi]

Q25: What federal policies could unleash additional corporate and philanthropic investment?

Better federal policies can help here—for example, a more generous R&D tax credit that also allows start-ups to take it could spur more corporate R&D. Also, more energy R&D programs requiring private/philanthropy matching could get more non-public skin in the game. The Administration should expand the use of prizes and grand challenges matched by corporate and philanthropic donors.

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