

Winning the Race for Innovation Advantage *with* the Eight “I’s” of Innovation Policy

How can the United States apply the lessons learned from other countries in crafting its own effective innovation policy? We’ve seen that the United States suffers from many of the same ailments that led to the United Kingdom’s industrial decline, including a persistent blindness to the problem. But like someone who goes on a diet and starts exercising after an overweight friend suffers a heart attack, perhaps America can learn from Britain’s economic “heart attack” and begin a rigorous diet and exercise program for industrial renewal.

The key is whether America can act before it’s too late. The lesson learned from the United Kingdom (as we discuss in chapter 3) is that if a nation passes a critical inflection point, it becomes extremely difficult to restore lost industrial innovation capabilities. To understand why, consider that after World War II (WWII), U.S. industrial innovation leadership was built on a complex, interlocking, and mutually reinforcing ecosystem. This involved original equipment makers producing complex products; spin-offs, many of which became successful companies in their own right; suppliers; providers of specialized business services (e.g., venture capitalists);

educational institutions producing skilled workers, knowledge, and discoveries; testing labs, standards, and other innovation infrastructures; and a growing market of sophisticated customers—all knit together by a complex system of interactions among the players. As each component became stronger, others followed suit, and a positive upward cycle resulted.

However, leadership is never assured, either for companies or nations. Advantages can become disadvantages, particularly if the environment changes. Companies and nations can become committed to conventional ways of doing things and fail to take advantage of new opportunities. To paraphrase former Intel CEO Andy Grove, problems start when companies and nations stop being paranoid about competitive threats. When this happens, a virtuous cycle can transform into a negative one.

America is not yet at the precipice that the U.K. economy fell from, though the economic ship of state is sailing dangerously close. While it’s not yet too late to turn things around, there will come a time, perhaps in the very near future, when regardless of how attractive the United States makes science, technology, engineering, and math (STEM) education; how much money it invests in research; how much it lowers its corporate tax rate; or how low the dollar falls, it will not be able to easily regain a robust industrial innovation capability. Many of the key pieces will have been too fully dismantled. We don’t mean to imply that America needs to restore all jobs in all industries. That is neither possible nor desirable. We do mean that the United States should seek to be an economy that runs trade surpluses in complex, technology-based industries (in order to pay for the imports of commodities and low-skill products) and that is competitive not just in the research and development (R&D) of new products (including intangible products like software and content) but also in the ability to manufacture many of those complex products domestically.

What would it take to achieve this? Clearly, many specific issues need to be addressed. Numerous reports, books, and articles have proposed solutions, such as improving the patent system, improving education, or reforming the corporate tax code. As in chapter 6, rather than offer a laundry list of programs and policies, we present the seven “I’s” of innovation policy: Inspiration, Intention, Insight, Incentives, Investment, Institutions,

and IT (information technology); except this time we add an eighth—International—and apply them in terms of how the United States needs to get each right.

Inspiration: Setting Ambitious Goals

If the United States is going to act, it first must overcome its shortsightedness, partisanship, and ambivalence toward innovation. Inspiration can come from “stretch” goals. Fifty years ago, President John Kennedy proclaimed that the United States “should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth.” This was an audacious goal that many said could not be achieved. But by bringing together the genius of American engineering talent, dynamic companies, and government commitment, America achieved it. Likewise, in the 1990s, America set a goal of sequencing the human genome in a decade and by combining government support and private-sector initiative, America again accomplished its goal.

Landing a man on the moon is now trotted out as the inspirational metaphor for solving an array of problems, but it’s not the right one for this crisis. While the moon landing was difficult, it was after all a relatively straightforward and discrete engineering challenge. Restoring U.S. innovation leadership is a profoundly more complex and less tangible task than going to the moon. But that does not mean that the United States should fail to set similarly audacious goals. Here are five ambitious goals worth achieving by 2020:

1. Eliminate the trade deficit and turn the \$100 billion deficit in high-technology products and services into a \$100 billion surplus. Neoclassical economists will recoil in horror at any such goal because for them the trade deficit either poses no problem or simply results from our low savings. But the trade deficit is a problem because it represents both a loss of U.S. global competitiveness and a debt that future generations must repay. There is no reason why the United States could not balance its trade terms within a decade.
2. Add two million new jobs in technology industries, expanding tech jobs (e.g., IT, biotech, pharmaceutical, clean energy, and advanced

manufacturing) by one-third. Overall U.S. employment is expected to expand by just 10 percent by 2020, so this would be an ambitious goal. Achieving it would not only create two million high-wage jobs but also millions of related jobs from the multiplier effect.

3. Raise the rate of productivity growth by 50 percent. From 1957 to 2009, the average rate of productivity growth per decade (not compounded) ranged from a high of 34.6 percent from 1957 to 1966 to a low of 11.9 percent from 1973 to 1982. From 2000–2009, it averaged 26.4 percent. Looking at five-year periods, productivity growth ranged from 21.2 percent between 1948 and 1952, to just 4.2 percent between 1977 and 1982, to 8.7 percent between 2005 and 2009. If we can raise the annual productivity rate from 1.65 percent per year (the average from 2005–2009) to 2.45 percent, it will take just twenty years, instead of thirty, to boost per capita incomes by 60 percent.
4. Leverage IT to transform U.S. government, transportation, health care, and education systems. The United States leads the world in the use of IT within business, but it lags in the use of IT in many other areas. Thus, it should make it a goal to have all medical data in digital format (such that all patients have electronic health records), for all travelers to have access to real-time information for roads and transit, for all information-based government functions to be digitized and online, and for higher education to provide a significant share of education online.
5. Develop clean energy sources whose unsubsidized price is lower than fossil fuels. Absent subsidies or carbon taxes, clean energy is not cost competitive with fossil fuels. Until it is, the planet will not transition away from carbon-based fuels. But driving sustained energy innovation has the potential to make using clean energy a money-saving decision.

Intention: Make Innovation-Based Competitiveness a National Priority

In 2010, the *Washington Post* series “Top Secret America” described the rapid growth of the national intelligence establishment after the terrorist

attacks of September 11, 2001, reporting that “some 1,271 government organizations and 1,931 private companies work on programs related to counterterrorism, homeland security, and intelligence in about ten thousand locations across the United States.”¹

Whether this apparatus is too large or too small is not the point. The point is that when the United States feels that its national security interests are threatened, there is bipartisan support for a massive response. The message to America’s adversaries is unambiguous: threaten U.S. national security and America will spare no expense in responding and defending itself. This is not new. Once the United States committed to winning WWII, it was all-in. Once it committed to winning the cold war after George Kennan’s 1946 Long Telegram, it was all-in. John Kennedy’s inaugural address summed up the view: “Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, in order to assure the survival and the success of liberty. This much we pledge—and more.”²

But no U.S. president has said: “Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, in order to assure the survival and the success of U.S. innovation leadership.” In fact, when it comes to economic security through innovation and competitiveness, the American hawk turns into a dove. Even bringing up the idea of defending U.S. economic interests produces such responses from the Washington economic policy elite as: “Getting tough on mercantilists will just promote a trade war”; “It’s okay for developing nations to cheat, after all, America did too in the 1800s”; “We don’t need an innovation policy, the private sector handles that”; “Competition between nations is a myth”; and, of course, the old chestnut, “We’re still number one, so stop worrying.”

Imagine if members of the U.S. national security community suggested that “Getting tough on our enemies will just encourage them to attack us” or “It’s okay for rogue nations to get nukes, after all we’ve got our nukes.” They would be ridiculed and expelled from the Washington national security establishment. Yet, when it comes to national economic security, this kind of thinking not only goes unpunished but instead is rewarded as prudent and insightful.

So the most important step for the United States is not to pass a particular bill to make the tax code more supportive of innovation, to spur technology transfer from universities, or to make any other discrete move toward renewal (though all are needed). Rather, foremost, the United States needs a new “Washington Consensus” that is focused not on the rest of the world but on America. The term Washington Consensus was first coined by economist John Williamson in 1989 to describe ten specific economic policy prescriptions that he recommended global institutions like the World Bank and the International Monetary Fund (IMF) impose on developing nations seeking their assistance.³ But there is another implicit Washington Consensus that has to do with broadly shared views about U.S. domestic economic policy and innovation. And the United States needs a new domestic Washington Consensus among the Washington economic policy elite about how to revive the U.S. economy.

Who are these Washington economic policy elites? While membership changes with new entry and retirements, it consists of leading academic neoclassical economists focused on economic policy as well as current and former leading government policymakers (particularly those at the Treasury, the Office of Management and Budget [OMB], the White House Council of Economic Advisors, and the National Economic Council, along with members of the Congressional Finance and Budget Committees and the Congressional Budget Office). Also among the elite are prominent scholars at think tanks like the Council on Foreign Relations, Brookings Institution, American Enterprise Institute, Peterson Institute for International Economics, and the Center for Strategic and International Studies.

It is immaterial whether these elites are Democrats or Republicans, for they share many of the same underlying beliefs and policy views. They do so in large part as a manifestation of what social psychologist Irving Janis famously termed “groupthink.” Groupthink refers to a “deterioration of mental efficiency, reality testing, and moral judgment that results from in-group pressures.”⁴ When the head of the White House National Economic Council says that the United States doesn’t need a manufacturing strategy because manufacturing is declining in all nations (though it’s not, as we describe in chapter 4) and the response is silent assent, the Washington Consensus groupthink is at work.

Ten key principles constitute the current Washington Economic Consensus:

1. The United States is the world leader in innovation-based competitiveness and likely always will be because it is the most open, entrepreneurial, and market-driven economy.
2. Government's job is to ensure that markets are competitive and that entry, exit, and prices are not distorted.
3. Fiscal discipline is the key and in efforts to balance the budget, everything should be on the table."
4. Globalization is an unalloyed good for the United States, even if other nations engage in innovation mercantilism.
5. Mercantilist nations only hurt themselves.
6. America's role in the global economy is to be a shining "city on the hill" that, by force of example, shows misguided nations why mercantilism and "industrial policy" are wrong.
7. Government can do little to spur innovation; it's something that just happens. In the words of Nobel Prize-winning economist Robert Solow, it is "manna from heaven."
8. The best tax code is a simple one, with a broad base and low rates.
9. To the extent that a more active government role is needed, it should be to support basic "factor conditions," such as science and education.
10. Government should refrain from "picking winners."

These views are almost never questioned—that is why they represent a consensus. In fact, questioning the consensus is risky. To enjoy the perks of being in the "club" (for example, being invited to the right dinners, being asked to join an administration in the right position, being on the board of the right organization or company), one not only must subscribe to the consensus but also defend it against all enemies, foreign and domestic. Not doing so opens one up to the risk of being seen as odd at best, irrelevant at worst.

Despite these risks, as it becomes clearer that the U.S. economy is not doing so well in innovation-based global competition, a few respected individuals have begun to speak out against components of the consensus, in-

cluding Intel CEO Paul Otellini, former Intel CEO Andy Grove,⁵ Eli Lilly CEO John Lechleiter, Dow Chemical CEO Andrew Liveris, Boeing CEO James McNerney, General Electric (GE) CEO Jeffrey Immelt, Harvard Business School's Willy Shih and Gary Pisano, and MIT's Paul Samuelson.⁶ As the structural nature of the U.S. economic challenge becomes clearer, other elites will likely join in. The critical question is whether it will become safe enough for people other than CEOs and retired economists to challenge the Washington Consensus. In either case, the critical first step is to replace the dysfunctional Washington Economic Consensus with a new Washington Innovation Consensus based upon the following ten principles:

1. While the United States retains important strengths, it is no longer the leader in innovation-based competitiveness and likely will continue to decline unless business, labor, academia, and government work together.
2. The major economic role for government is to ensure that institutions (e.g., businesses, governments, nonprofits) support and foster innovation.
3. Fiscal discipline is important, but funding for policies to spur innovation and competitiveness (including lowering corporate tax rates, even if it is not "revenue-neutral") should not "be on the chopping block"; rather, funding for such policies should be expanded.
4. Globalization can be an unalloyed good for the United States, but only if other nations generally play by the rules and America steps up its innovation game.
5. Mercantilist nations sometimes help themselves and almost always hurt the United States.
6. America's role in the global economy is to be a tough competitor that looks after its own economic interests first and joins with other like-minded nations committed to enforcing the global rules of fairly growing an innovation economy.
7. Innovation is a product of intentional human action that can and should be encouraged by policy.

8. The best tax code is one that includes incentives for spurring innovation and competitiveness.
9. While government needs to support “factor conditions” (e.g., basic scientific research and education), that alone is not enough to ensure a nation a pioneering position in innovation activity. More proactive innovation policies are needed.
10. Government can and should “pick winners” in the sense of identifying general industries and broad technology areas of national economic importance and playing a catalytic role in marshaling public and private resources to meet clear opportunities and challenges.

To be clear, we are not advocating merely exchanging one groupthink paradigm for another. Rather, we are recommending trying something new, thinking in new ways, and adjusting our frame of reference. The Washington Economic Consensus has its roots in the post-WWII economic reality, and it worked for a long time. But the world of 2012 is nothing like that of 1945, and U.S. economic elites need to shake up their thinking. Perhaps in 2050 the Washington Innovation Consensus will itself have become stagnant in its orthodoxy. If so, economic thinkers should reassess it. For now though, we are a long way from revitalizing our prevailing thinking.

Insight: Improving Understanding of Innovation Performance

Inspiring the nation and developing the intention to win are key first steps. But without insight on how the United States is doing with regard to its strengths, weaknesses, threats, and opportunities, the best of intentions will fall short.

Notwithstanding the hundreds of millions of dollars spent every year and the thousands of economists working for the federal government, the exact nature of the challenge and U.S. capabilities are only weakly understood. A Treasury Department official recently e-mailed a colleague, asking: “In what sectors is China catching up, so that Chinese companies are increasingly competitive with U.S. companies? I’m hoping we can find some subjective assessment that points to certain particular firms/industries. For example, we’ve seen some information that suggests Huawei is a

real competitor for Cisco and others in the world of wireless and network infrastructure.” Can you imagine a Department of Defense (DOD) official e-mailing a Washington think tank, asking: “What areas of the Chinese defense system are strong?” This was not the fault of the Treasury official, and kudos to him for reaching out to try to get better information. But it is emblematic of the fact that the United States has never felt that it needed to develop this kind of strategic economic intelligence to really understand the competitive position of the U.S. traded sector.

As George Washington University scholar Andrew Reamer notes, the opacity and limitations of our national statistical system for measuring innovation, productivity, and competitiveness make achieving this insight daunting.⁷ Established after WWII, the system was designed to help policymakers avoid another Great Depression, and therefore measured things like the number of houses built and cars manufactured. It did not measure innovation in the construction industry, how competitive the auto industry was, or any other number of important matters regarding the competitiveness and innovativeness of the U.S. economy; the assumption was that these things took care of themselves. Besides, we were so dominant, it didn’t matter.

If government is going to effectively support private-sector innovation in America, it needs to get much smarter. The very existence of government policies (tax, trade, regulation, spending, and so forth) means that government inevitably influences innovation and competitiveness, sometimes for good, sometimes for ill, but almost always by happenstance. Government would be much better positioned to effectively support innovation if it were more strategic and knowledgeable.

The place to start is to develop a national innovation and competitiveness strategy and to engage in a comprehensive analysis of the key factors contributing to the competitiveness of traded-sector establishments. Private-sector firms like Intel, General Electric, and Microsoft have strategies. Nations like Britain, Canada, Finland, Japan, and Korea have strategies, as we discuss in chapter 6. U.S. states like Massachusetts and Washington have strategies. But the United States does not, at least not a strategy based on a comprehensive analysis of traded-sector strengths and weaknesses, opportunities and threats, and the viability of a range of public policies affecting them. Whereas many other countries have coherent, strategic

game plans to compete and win in the highest value-added sectors of economic activity, the United States relies on makeshift reports and one-off policies that all too often are not tied to any serious, analytically based, and coordinated strategy.

Components of the national innovation and competitiveness strategy should include an assessment of: (1) current U.S. competitiveness, including for traded sectors at the major industry level (three-digit North American Industry Classification System [NAICS] codes); (2) current business climate for competitiveness (including tax and regulatory policies, as well as the overall system for private-sector business investment) and how it stacks up to major competitors; (3) trade and trade policy issues; (4) education and training; (5) science and technology policy; (6) regional issues in competitiveness (including the roles of state and local governments and federal policy impacts on innovation and competitiveness in rural and urban regions); (7) measurement and data issues; and (8) proper organization of government to support a comprehensive innovation and competitiveness agenda. The National Competitiveness and Innovation Strategy Act of 2010 (S. 3620), passed at the end of 2010 and signed into law by President Obama, charged the administration to undertake this, but unfortunately the report took only a broad-brush look at the challenges.⁸

To take the next steps, the federal government should start by getting more strategic about promoting the competitiveness of high-value-added sectors. Currently, federal agencies work to advance their own particular missions and are largely unwilling to take into account the impact of their actions on innovation competitiveness or to coordinate with other agencies. Medical devices are a good example. The Food and Drug Administration (FDA) reviews the safety and effectiveness of medical devices. The Department of Health and Human Services sets reimbursement schedules. The DOD and the Veteran's Administration procure such devices. But there is little or no coordination across agencies to develop a unified strategy to orient government policies to support the competitiveness of the U.S. medical device industry, even though it is a high-value-added sector in which the United States still retains competitive advantage, even though that position is at risk.⁹ Accordingly, the Department of Commerce should develop strategic road maps and guide interdepartmental collabora-

ernment agencies are, wherever possible, aligned to promote the global competitiveness of strategic sectors of the U.S. economy.

One can almost hear the howls of outrage, whether from the "Glenn Becks" of the Right that this amounts to "a secret government plan to take over private business" or from the "Al Sharptons" of the Left that this is "some kind of secret plan to maximize corporate profits." But developing a national innovation and competitiveness strategy is not the same as developing a heavy-handed industrial policy. A thorough analysis of U.S. innovation-based competitiveness is just as likely to find problems from too high a corporate tax rate, too many regulations, and too many tort lawsuits as from inadequate federal support for collaborative industry-university research institutes. Nor does helping corporations become more competitive constitute a plot against workers. To the contrary, U.S. workers cannot thrive unless U.S. business establishments are innovative and productive.

Incentives: Encouraging Innovation, Production, and Jobs in the United States

Nondemocratic nations can force companies to innovate, or at least make them try. Democratic countries cannot and should not. Harangue, pressure, and other "sticks" won't produce innovation or competitiveness. But that has not stopped some from trying. In the United States, the Obama administration is trying to induce American companies to produce more domestically by proposing to end their ability to defer U.S. foreign-source income. In February 2012, the administration announced a series of tax reform proposals whereby the overseas earnings of U.S. corporations would be taxed at a "minimum" rate regardless of whether or not the earnings are repatriated. The administration argued that permitting U.S. corporations to defer recognition of their foreign source income until they repatriate the income encouraged them to ship jobs overseas and deprived the U.S. Treasury of revenue. Ending deferral, the administration contends, would stop "subsidizing" the export of jobs.

If it were as simple as that, what's not to like? Government revenue and jobs would both go up. But it's not that simple. If U.S. affiliates in a lower-tax nation sell much of what they produce there to nations other than the

will make them less competitive with firms from other nations that are subject to the lower national rate. Since these competitors would enjoy relatively lower costs, they would export more, including to the United States, taking market share away from U.S. firms. Thus, making foreign affiliates of U.S. firms pay the higher U.S. rate could shift imports to non-U.S. foreign firms and reduce global market share of firms headquartered in America. As Reed College economist Kimberly Clausing notes, ending deferral would “exacerbate concerns regarding the international competitiveness of U.S.-based multinational firms, as U.S. firms would face a tax disadvantage relative to firms based in other countries when operating in low-tax markets.”¹⁰ At best, it appears that ending or limiting deferral could have mixed results, perhaps spurring some activity to locate or to remain in the United States, but also reducing jobs offered in America by U.S.-headquartered companies that serve global operations (such as R&D, management, sales, or marketing jobs).

In this specific case, lowering the effective corporate tax rate, rather than ending deferral, is the preferred strategy. More generally, the better way to spur innovation-based competitiveness is to provide more incentives to invest in the United States. Indeed, to maximize innovation, countries need to provide organizations with incentives. Nobel Prize-winning economist Douglass North summed up the secret sauce of innovation success this way: “We must create incentives for people to invest in more efficient technology, increase their skills, and organize efficient markets.”¹¹

Figuratively speaking, most nations were absent for the lecture in Economics 101 that incentives are bad because they distort allocation efficiency. But unlike other pupils, Uncle Sam went to class that week, wrote a term paper on why incentives are bad, and got an A for it. The U.S. government has no “war chest” from which it can draw incentives to attract or retain multinational establishments. Its workforce training, R&D, and capital expenditure tax incentives are either nonexistent or anemic. And at 39.1 percent, the combined state-federal statutory corporate tax rate on U.S. companies is now the highest in the world, after Japan cut its corporate tax rate on April 1, 2012.¹² Indeed, while statutory corporate tax rates fell, on average, by 16 percent across all the Organization for Economic Cooperation

and Development (OECD) economies from 2000 to 2009, they remained constant in the United States. In contrast, the statutory corporate tax rate fell by 48 percent in Ireland (from a tax rate of 24 percent to 12.5 percent); by 43 percent in Germany (from a rate of 52 percent to 29.8 percent); and by 19 percent in Canada (from a rate of 44.6 percent to 36.1 percent). In fact, the United States was the only country in the OECD in which the statutory corporate tax rate did not decline between 2000 and 2010.¹³

Some argue that while the U.S. statutory rate is high, the effective tax rate is actually low. After all, just look at companies like GE that supposedly pay very little in taxes. However, with respect to the effective corporate tax rate, which takes account of credits, deductions, and other incentives that corporations receive, the U.S. rate is also quite high. According to the World Bank, at a combined state-federal rate of 32 percent, the U.S. effective corporate tax rate is one of the highest in the developed world.¹⁴ In a cross-country analysis of effective corporate tax rates, business school professors Kevin Markle and Douglas Shackelford found that among multinational firms, U.S. multinationals “are among the highest taxed” and that U.S. manufacturers (domestic and multinationals) were the third-highest taxed of the group of countries analyzed, paying taxes 37 percent higher than manufacturers in Asia.¹⁵

This negative incentive clearly hurts America’s ability to maintain a globally competitive industrial economy, since lower effective corporate tax rates spur greater foreign direct investment (FDI) coming into a country while reducing outward FDI. This effect has become more pronounced as the race for innovation advantage has intensified. Altshuler finds that a 1 percent reduction in an average country tax rate in the 1980s raised FDI by 3 percentage points; by the 1990s, a 1 percent reduction in average country tax rates raised FDI levels by 3.7 percentage points.¹⁶ Moreover, a 10 percent increase in a country’s effective corporate tax rate reduces its investment-to-gross domestic product (GDP) ratio by 2.2 percent and reduces its FDI inflows by 2.3 percent.¹⁷

While this international tax-based competition is relatively new, it has been going on at the state level for more than half a century. Indeed, when the U.S. economy became fully national in scope after WWII, states were forced to compete for mobile corporate investment. They had no choice but

to lower their corporate tax rates, increase their corporate tax incentives, or both. Because of this, from 1970 to 2008, corporate taxes as a share of state tax revenues fell from an average of 8.3 percent to 6.2 percent. Now the United States finds itself in the same position; it has to compete for internationally mobile investment and it needs a more competitive corporate tax code to succeed. The reality is that the U.S. government lost the freedom to unilaterally design its own corporate tax system twenty years ago. It just doesn't know it because it continues to wrap itself in the comforting illusion that it is not in competition or that the unique characteristics of the U.S. economy allow it to have a higher corporate tax rate with no penalties.¹⁸

What would the U.S. corporate tax code look like if the federal government recognized the competitive reality? Clearly, the effective rate would be lower. Cutting the effective rate will be important not only to making the U.S. economy more competitive but also to reducing the amount of corporate tax deferred inside other nations. But the real question is how to do this. There are two main choices: the first is to reduce the statutory rate of 35 percent; the second is to reduce the effective rate, but mostly through incentives.

Most companies and virtually all neoclassical economists favor a lower statutory rate; the former want certainty in the tax code and the latter object to the idea of the tax code substituting for the wisdom of the market. Indeed, for many tax policy experts, effective corporate tax reform means simplifying the code by removing some or even all exemptions, including critical ones such as the R&D tax credit and accelerated depreciation, and using the savings to reduce statutory rates.¹⁹ However, any revenue neutral tax reform that reduces or eliminates key incentives for investing in research, capital equipment, and manufacturing will make things worse, not better.

In fact, the tax code should substitute for the wisdom of firms and it should not be certain. When there are significant economy-wide benefits from firms investing in a particular way, it is entirely appropriate for a bargain to be made: business can pay less in taxes if it takes steps that maximize economy-wide benefits. And it should be uncertain in the sense that firms will pay lower taxes only if they take certain actions.

What are those actions? We know that three types of corporate investment—research and development, investments in new capital equipment (including software), and training frontline workers—drive growth

and innovation.²⁰ Because incentives make a difference in encouraging companies to make these types of investments, the United States needs to take three key steps: First, the R&D tax credit needs to be significantly expanded—and made permanent. There is a consensus in the scholarly literature that R&D tax incentives spur firms to invest more in R&D than they would otherwise.²¹ Twenty years ago, the U.S. R&D credit was the most generous in the world. Today, because many nations have instituted their own, more generous R&D tax incentives, U.S. R&D tax credit generosity has dropped precipitously in rank, to twenty-seventh in the world. Expanding the credit would help make the United States a more attractive location for internationally mobile R&D and lead to greater R&D investment in America.

But while R&D is one critical component of an innovation economy, so too are worker skills. While training and ongoing education are critical components of robust productivity growth, companies in the United States are investing about half as much in training as a share of GDP as they did a decade ago, in part because the payoffs increasingly flow to other firms since workers switch jobs more frequently and in part because companies are under increasing pressures for short-term profits.²² To spur greater workforce training, Congress should institute a tax credit for expenses associated with that training.²³ Finally, an effective innovation policy needs to lower after-tax prices for equipment and machinery (including software). Providing a tax credit on equipment and machinery will spur more domestic investment and enhance productivity.

Rather than provide three separate credits, however, Congress should create a unified Innovation and Investment Tax Credit (IITC), building off the Alternative Simplified Credit (ASC) for R&D. The ASC provides a credit of 14 percent on R&D expenditures above 50 percent of the average of the last three years. The credit could be even more effective if the rate were increased and applied only to investment above 75 percent of the base. Thus, we propose that the IITC provide a credit of 45 percent on expenditures in R&D and skills training above 75 percent of base-period expenditures. Because capital expenditures are much greater than expenditures for workforce training, we propose that companies receive a lower credit of 25 percent on capital expenditures made in excess of 75 percent of their base-period expenditures.

To understand how this would work, consider the following hypothetical example. From 2009 to 2011, a company invests an annual average of \$10 million in R&D, \$10 million in workforce training, and \$50 million in new machinery, equipment, and software in the United States. In 2012, it invests \$12 million in R&D, \$12 million in training, and \$60 million in machinery, equipment, and software. Under the IITC, it would be eligible for a credit of \$9.67 million (45 percent of \$9 million for R&D and training, and 25 percent of \$22.5 million for machinery and equipment).

A robust IITC would go a long way toward helping establishments in the United States become more competitive globally, both by reducing their tax liability and by encouraging them to invest more in the drivers of innovation and productivity. It also would make the United States a more attractive location for inward foreign direct investment. Moreover, when compared to an across-the-board corporate rate reduction alone, these incentives would be more targeted toward those industries and firms that are most exposed to international competition. Software companies would get more incentives, law firms fewer. Automobile producers would get more, automobile rental companies fewer.

Opponents will raise at least three objections. To start with the most valid one—cost—the IITC would not be cheap. It would cost approximately \$75 billion per year to reduce corporate tax payments by 17 percent through incentives. Can the federal government afford this in a time of fiscal constraint? It can, for two reasons: First, because the IITC spurs growth, it provides offsetting revenues. One reason for this is that higher tax rates lead to less investment (and, therefore, lower tax revenues) and also to more income shifting. Indeed, a study by the World Bank finds precisely this, reporting that, “high tax rates do not always lead to high tax revenues. Between 1982 and 1999, the average corporate income tax worldwide fell from 46 to 33 percent, while corporate income tax collections rose from 2.1 percent to 2.4 percent of national income.” While the notion that lower marginal tax rates produce more, not less revenue (the “Laffer curve”) does not apply to individual taxes (at least at today’s rates), it can apply for corporate taxes.²⁴ Clausen finds that the combined revenue-maximizing corporate income tax rate in the United States is 33 percent, significantly

lower than the current combined U.S. federal-state rate of 39 percent. The proposed IITC would lower the combined rate to just below that, to 32.4 percent. So lowering the rate this way would in theory not reduce revenue. Moreover, these incentives can also partially or fully pay for themselves because they will spur greater competitiveness and productivity, which will also lead to greater tax revenues. For example, boosting the R&D tax credit would pay for itself, albeit after fifteen years, because productivity, and therefore tax revenues, would be increased.²⁵

For those who would insist on up-front offsetting revenue raisers to pay for the IITC, there are several options. Eliminating the 2001 tax cuts for the wealthiest 2 percent of earners (those earning above \$250,000) would almost completely close the gap, producing about \$65 billion a year. Does anyone really believe that the better way to grow the economy is to let high-income individuals keep \$65 billion more of their earnings to buy another Armani handbag or Jaguar car, instead of letting the business engines of competitiveness and innovation save \$65 billion in taxes to invest in research, skills, and equipment?

Another way would be to restore the tax rates on dividend income to their pre-2003 levels. This would have the added advantage of encouraging companies to invest more in their firms, rather than disburse the money out as dividends. Congress also could institute a border-adjustable corporate activity tax (like a value-added tax), such that imports would be taxed, not exports.²⁶ (More than 150 countries apply such a border-adjustable consumption tax on their imports, which imposes a tax burden on U.S. exports.)²⁷ Carbon taxes are another source. A \$15 per ton carbon tax would raise \$90 billion a year, of which only about \$17 billion would be borne by manufacturers. When one nets out the fact that U.S. manufacturers would see tax reductions from the innovation-based tax incentives described above, the United States could impose a carbon tax and on net still improve the competitive position of its manufacturing sector.²⁸

Moreover, even increasing the budget deficit in the short term to pay for these incentives would be more than worth it. Cutting these types of tax investments to balance the budget is penny-wise and pound-foolish. As conservative columnist George Will wrote in reference to federal support

for science, "Making the government lean by cutting the most defensible—because most productive—federal spending is akin to making an overweight aircraft flight-worthy by removing an engine."²⁹

The second reason many holders of the Washington Consensus will oppose the ITC proposal is because it violates one of the central tenets of the consensus, that the best tax code is a simple one with a broad base and low rates. But this was not always a part of the Washington Consensus. From the 1950s to the early 1980s—a period of robust growth—the federal government provided incentives for companies to invest more in capital equipment. Under the Kennedy administration, two measures were enacted to spur investment: shortened depreciation schedules and a 7 percent investment tax credit. But by the 1980s, neoclassicists, who embrace the simplicity principle, had taken over. As a result, the 1986 Tax Reform Act was a Holy Grail for neoclassical economists, for it not only eliminated the investment tax credit but also increased corporate taxes while cutting individual taxes. Talk about getting it wrong all the way around.³⁰

One influential assault on the view that the tax code should favor investment in plant and equipment came from none other than Larry Summers, former director of the White House National Economic Council (NEC). In a 1979 article, Summers and fellow economist Alan Auerbach modeled the impact of instituting an investment tax credit (ITC). Not surprisingly, they found that a 12 percent ITC would increase the stock of equipment by 18 percent while also boosting GDP.³¹ Sounds good, right? Wrong. Their model also showed that the credit would lead to slightly higher interest rates and a crowding out of other "investment sectors." What exactly were these sectors? Housing! As a result, they opposed a pro-growth investment tax credit because it would distort allocation efficiency by leading to more investment in manufacturing and less in housing. Thus, since the late 1970s, the Washington Economic Consensus has been against investment incentives.

The third objection (as if the first two weren't enough) goes something like this: "How can you propose cutting taxes on multinational corporations when American workers are struggling?" For many on the Left, helping corporations is the last thing to do when workers are hurting. But just as neoclassical thinking on corporate taxes reflects a twentieth-century

mind-set, so too does this kind of Populist thinking. Rob Atkinson was former executive director of the Rhode Island Economic Policy Council, a public-private partnership established in the mid-1990s to help develop and guide an economic strategy for the state. After the council prepared a strategic economic development plan, it "went on the road" to present its recommendations to key stakeholders. One of the first stops was the Rhode Island Senate Democratic Caucus policy retreat. Accompanied by George Nee, president of the Rhode Island AFL-CIO, we presented the recommendations, including calling for Rhode Island to institute the most generous R&D tax credit in the nation and an investment tax credit. When we finished, one senator asked Nee: "I know we need to do things to help create jobs, but is there any possible way we can do this without having to help business?" To which Nee answered: "No." To their credit, the Senate Democrats supported this legislation, allowing Rhode Island to have a more competitive corporate tax structure, and to attract and grow more R&D and investment. If even some of the most liberal states in the nation have figured out that a competitive corporate tax code is not a choice but a requirement if workers are to prosper, surely Washington can do the same.

Investment: More Public Funding for Innovation and Productivity

If the United States is to ensure that companies expand R&D, commercialization, and production at domestic establishments, it needs to provide significantly more support for research, commercialization, technology adoption, and education and training.

America once led the world in investment in innovation. But the United States has fallen to eighth place among OECD countries in R&D intensity, and U.S. investment in R&D as a share of GDP increased by just 3 percent from 1987 to 2008. One major reason for this slippage has been a slowdown in federal R&D investment, as it grew in constant dollars at just 0.3 percent per year from 1987 to 2008—much lower than its average annual growth of 4.9 percent from 1953 to 1987, and ten times lower than the rate of GDP growth.³² In fact, to restore federal support for research as a share of GDP to 1987 levels, Congress would have to increase federal support for

R&D by almost \$10 billion—per year. When a nation underfunds research by such a whopping amount, industrial decline should not be a surprise.

If we are optimistic and assume that the United States will increase investment in innovation by just a fraction of what it should—at least \$30 billion per year—where should this funding go? To be sure, we need funding increases at agencies like the National Science Foundation (NSF), the National Institutes of Health (NIH), and the Office of Science at the Department of Energy. But while necessary, these increases are not enough. If we are to win the race for global innovation advantage, we need to also expand funding for programs targeted explicitly toward supporting industrial innovation. Funding for programs like the NSF and NIH are important, but the days when we could expect the discoveries coming from scientific research to flow predominantly to companies in the United States are long gone. Now knowledge flows across the globe, benefiting U.S. establishments (albeit more) as well as our competitors. Without other programs focused on the transfer of innovations to U.S. establishments, America won't fully reap the benefits of these investments.

Congress should increase funding for the Defense Advanced Research Projects Agency (DARPA) and the National Institute of Standards and Technology (NIST). But as chapter 6 notes, to even come close to matching the investments of peer countries, the United States should be investing at least \$5 billion more per year on efforts to spur industrial innovation. A number of programs deserve increased support. Congress should expand support for NSF programs that work more closely with industry, including the Engineering Research Center and the Industry/University Cooperative Research Center programs, Partnerships for Innovation, and the Advanced Technical Education Program. These programs receive less than 2 percent of the NSF's budget.³³ The United States should significantly expand the industrially oriented programs at NIST, including the Technology Innovation Program and the Manufacturing Extension Partnership. The latter program is particularly important to helping restore U.S. manufacturing competitiveness since it works to help small manufacturers become more innovative and productive, but as noted, it is significantly underfunded compared to peer programs in competitors such as Canada, Germany, and Japan.

One key to supporting industrial renewal is to help firms in the same industry conduct collaborative research that helps the entire industry. One

of the best examples of this is the Semiconductor Research Corporation (SRC). Thirty years ago, the U.S. semiconductor industry faced challenges from foreign competition. In response, visionary industry leaders, with help from the Defense Department, formed the SRC to invest in and to manage long-term research addressing the industry's technology needs and to create a pool of experienced university researchers and a pipeline of graduates knowledgeable about semiconductor science and technologies. Based on alignment of industry and government needs, including recognition of the need for a robust technology workforce, the SRC established research programs jointly funded with DARPA, NSF, and NIST. The SRC has had a substantial impact on both industry and academia. SRC investment has built a network of more than one thousand university collaborators working in the semiconductor field. Materials, design tools, and processes based on SRC research are widely used across the industry. Just as significant as the technological output has been the impact on human capital. The SRC has supported more than 8,400 graduate and undergraduate students, almost all of whom remain in the semiconductor field as researchers and innovators.³⁴

The SRC would not have been formed or continued without government support. We should replicate this model across other industries and technologies. NIST is attempting to do this with the Advanced Manufacturing Technology Consortia (AMTech) program, which is a public-private partnership initiative that provides federal grants to leverage existing consortia or to establish new ones focused on long-term industrial research needs. The grants would fund development of research road maps and projects in advanced manufacturing and enhance the research productivity of consortia members through improved coordination and efficiencies. The program's goal is to accelerate the innovation process—from discovery, to invention, to development of new manufacturing process technologies—in order to support the creation of new high-skilled, high-wage manufacturing jobs. But AMTech's initial funding request was at just \$12 million per year, and the Obama administration is seeking only \$21 million in FY 13; funding for the program should ramp up to at least \$500 million annually. The National Network for Manufacturing Innovation (NNMI), a \$1 billion proposal announced in March 2012 by the Obama administration, would provide such a framework by establishing fifteen institutes acting as hubs

of manufacturing excellence across key manufacturing technologies and sectors.³⁵

We also need to foster a better state-federal innovation partnership. Since the 1980s, all fifty states have established technology-based economic development (TBED) programs. Republican and Democratic governors and legislators support these programs because they recognize that businesses will not always create enough high-paying jobs in their states without support. But states only invest about \$2 billion annually in these activities, an amount dwarfed by the tens of billions they spend recruiting firms from other states. Because states are key partners in the U.S. innovation system, the federal government needs to better support their technology efforts. One way to do that would be to create a performance-based challenge grant program to cofund state TBED programs that would build off the Obama administration's well-intentioned but significantly underfunded regional innovation clusters initiative:

However, if we really want to get smart about promoting technological innovation, we could take a page from the playbooks of other nations and create a National Innovation Foundation (NIF). The NIF's goal would be straightforward—to help establishments become more innovative and competitive. It would do this by:

- catalyzing industry-university research partnerships through national-sector research grants;
- expanding regional innovation promotion through state-level grants to fund activities like technology commercialization and support for entrepreneurship;
- encouraging technology adoption by assisting small and midsized firms in taking on existing processes and organizational forms that they do not currently use;
- supporting regional industry clusters with grants for cluster development;
- championing innovation to promote innovation policy within the federal government and serving as an expert resource on innovation to other agencies.

Finally, one area that deserves its own focus is energy innovation. As chapter 4 notes, many nations are making major bids for clean energy lead-

ership by funding R&D and deployment efforts. As a result, the United States is at risk of getting left behind. One reason is limited funding for clean energy innovation. For example, while the stimulus legislation provided \$400 million to fund the Department of Energy's new Advanced Research Projects Agency-Energy (ARPA-E, modeled on the DOD's DARPA), the agency could only fund 1 percent of the 3,700 applications it received.³⁶ Unfortunately, Congress cut ARPA-E's funding to \$180 million in 2011.

Spurring an energy innovation revolution will require an array of policies, but the single most important one is to increase funding for clean energy R&D. This should include expanding funding for ARPA-E to at least \$1 to \$2 billion annually and providing funding for Energy Frontier Research Centers, which support small groups of researchers focused on breakthroughs in science and on working to solve specific technical problems that are blocking clean energy development. We should support the development of clean energy "clusters" to accelerate collaboration between multidisciplinary researchers in academia or government and corporate and venture capital partners that can contribute market insight and expertise. Total new funding for energy R&D should be on the order of at least \$5 billion annually.

Institutional Innovation: Doing New Things in New Ways

For most neoclassical economists, the royal road to prosperity is paved with price-mediated markets. If everyone sells and buys things based on the prices they agree to, economic welfare is maximized. To be sure, price-mediated markets are useful, but when it comes to innovation they are not enough. Adaptive efficiency—the ability of economies and institutions to change over time to respond to successive new situations, in part by developing and adopting technological innovations—is the key to growth and competitiveness. As innovation economist Joseph Schumpeter pointed out more than half a century ago, "A system which is efficient in the static sense at every point in time can be inferior to a system which is never efficient in this sense, because the reason for its static inefficiency can be the driver for its long-term performance." Where does this adaptive efficiency (that is, innovation) come from? One key place is institutional evolution. Douglass North explains: "We are far from knowing all the aspects of

what makes for adaptive efficiency, but clearly the overall institutional structure plays a key role to the degree that the society and the economy will encourage the trials, experiments, and innovations that we can characterize as adaptively efficient. The incentives embedded in the institutional framework direct the process of learning by doing and the development of tacit knowledge that will lead individuals in decision-making processes to evolve systems that are different from the ones that they had to begin with.³⁷ In other words, to win the race for global innovation advantage, nations cannot just be content with high rates of technical innovation; they also need high rates of organizational innovation. In particular, the United States needs to shake off complacency, move beyond partisan gridlock and ideological rigidity, and approach the task of institutional innovation with the same urgency that some of America's leading companies, such as Apple and IBM, did when faced with crises. Institutional innovation is critical. It is also hard. But when it occurs, it can be transformative.

Take the case of engineering education. In the early 1990s, a small cadre of visionaries from the corporate and academic sectors got together to examine the state of U.S. engineering education. What they saw gave them pause. Too much of engineering education was rooted in a model of teaching and research that was more than one hundred years old. This didn't help students become engineering innovators, nor did it effectively link engineering to businesses. Given the increasingly global and collaborative nature of engineering, this cadre began urging the addition of teamwork, project-based learning, entrepreneurial thinking, and communication skills to engineering curricula, as well as a greater emphasis on social needs and human factors in engineering design.

In 1997, an entirely new college was created in the suburbs of Boston to put that vision into practice. The Franklin W. Olin College of Engineering was created as a highly selective undergraduate engineering institution designed to prepare students "to become exemplary engineering innovators who recognize needs, design solutions, and engage in creative enterprises for the good of the world."³⁸ But the founders of Olin realized that they had to completely change the model of engineering education for this to work. They started with perhaps the most radical change: doing away with academic departments and faculty tenure. They decided that engineering ed-

ucation had to be interdisciplinary and integrated with hands-on learning and research opportunities for students. And they made a commitment to diversity, with the result that, in 2010, 44 percent of their all-engineering student body was female (compared to approximately 20 percent nationally), with minorities comprising 17 percent of the student population.

By all measures, Olin has been a tremendous model of institutional innovation. Approximately 80 percent of Olin graduates go into STEM fields and 25 percent are involved in start-up entrepreneurial enterprises (either full- or part-time), with 10 percent starting their own businesses. Moreover, on the National Survey on Student Engagement (NSSE), which assembles annual data from first- and senior-year students attending hundreds of colleges and universities, Olin's "Active and Collaborative Learning" Benchmark Score is among the highest in the nation. Employers of Olin graduates see them as exceptional.

If we want to win the innovation race, it's not enough to create just one Olin; we need hundreds or thousands, not only for engineering education, but in area after area of American society: K-12 education, health care, university technology transfer, surface transportation, electric utilities, government services, social services, and so forth. Over the years, these institutions have become stagnant, bogged down by the weight of convention, tradition, and inertia. We need to be engaged in systemic innovation in our institutions, trying many experiments and recognizing that many or even most will fail, but then widely adopting the ones that succeed (just like the private sector does). Most important, this means that our conception of innovation policy needs to be broadened from its current focus on science and technology to include institutions.

Unfortunately, institutional innovation is barely on Washington's radar screen. Democrats regularly resist institutional innovation out of fear that the new systems will not provide the kind of universal service characteristic of the bureaucratic, managerial government programs established after WWII, or worse, that they will act as a stalking horse for a Tea Party-like attack on government itself. And all too often, in their zeal to rein in big government, Republicans would rather shrink it than drive it to innovate.

On top of this, a deeply inherent conservatism in the field of public administration leads congressional and federal agency staff to view too many

policy areas and institutions as simple, mechanistic systems. And it leads them to view their jobs as a matter of pouring more resources into the front end to get more outcomes at the back end, as adding a regulation here or there that will force the system in question to behave differently, or as mandating that organizations do certain things. And when they do legislate or regulate, much too often their proposals are premised on the view that our public, private, and nonprofit institutions are working just fine—all they need is more: more money, more authority, and so forth.

Occasionally, institutional innovation breaks through. The 1996 Welfare Reform Act is an example, as are some components of the Obama administration's "Race to the Top" education reform initiative. And, to be sure, there are leaders on both sides of the aisle who embrace institutional innovation. For example, former Republican House Speaker Newt Gingrich has been a leader in calling for new kinds of institutions, such as the creation of what he terms a "21st Century Intelligent Health System." But these actions and leaders are the exception rather than the rule.

America needs to do better. For the U.S. innovation economy to succeed, American institutions must themselves embrace innovation and constantly adapt and evolve to improve and to do things in new and creative ways. And to drive institutional innovation, policymakers need to view policy areas as complex systems with multiple actors having different motivations, multiple feedback loops, uncertainty, and a host of other complex factors, such that simple and "obvious" solutions are not always right. There are no stock formulas to drive institutional innovation. While the right answer will depend on the particular context, a number of approaches can be used, including the following:

Prizes

Most organizations respond to incentives. If we want organizations to innovate, we should offer prizes. For example, rather than simply give more money to colleges and universities and hope they increase U.S. graduation rates in STEM disciplines, we should award cash prizes to colleges and universities that have dramatically increased STEM degrees and maintained those increases over five years.

Markets

In too many areas, organizations fail to innovate because there is too little competition. We see this in the slow pace of adoption of the smart electric grid by electric utilities, of intelligent transportation systems by state departments of transportation, and of new forms of schooling and pedagogy by public schools. In all cases, enabling more competitive markets can help create incentives for change. For example, Congress should pass legislation to require electric utilities to share data on electricity use with customers so they can use that data with any smart grid application service provider. It should dramatically reduce federal restrictions on tolling federal highways and use the highway trust fund to reward states that shift more to tolling and pricing of roads. It should also support more experimentation with school vouchers and charter schools. The list goes on and on.

Information

One reason organizations do not change is that many times their customers are not aware of just how poor their poor performance is. Open information can change that. In higher education, for example, the federal government should require all colleges and universities receiving federal money to report their results from the National Survey of Student Engagement, the survey in which Olin excels. This information would allow parents, teachers, students, funding agencies, and other stakeholders to compare institutions of higher learning based on real performance, not just on the superficial information they get in rankings like the *U.S. News and World Report* survey.

Congress could also help establish stronger university entrepreneurship metrics. This could be achieved in several ways. First, the United States could collect better data on the number of new businesses started by a university's faculty and on the total number of spin-off companies created by each university. Congress could direct the National Science Foundation (NSF) to develop a metric by which universities report that information annually. NSF could use this data to reward universities that do a better

job, for example, by also giving bonus points on research grant proposals they receive. Applicants from universities that do a great job of promoting entrepreneurial spin-offs/start-ups would be more likely to have their private investigator grants funded. In addition, the Department of Commerce should use data available through the ES-202 form (Unemployment Insurance Tax Records), which tracks how many employees an establishment has every quarter. The form could also be made to note the university that the founder of the organization attended, and then that information could be combined, anonymously, to find out which colleges and universities have graduates that are founding and running the most high-growth businesses.

New Kinds of Organizations

Even with these incentives, many institutions will still resist change. As a result, sometimes the best approach is to start from scratch and create entirely new institutions. A case in point is science, technology, engineering and math education. One promising strategy for helping more American high school students graduate with expertise and interest in science is to create new high schools explicitly focused on STEM education. To date, there are only about one hundred of these innovative math and science high schools in the United States, but their graduates pursue undergraduate and graduate degrees in STEM fields in relatively greater numbers than graduates from traditional high schools.³⁹

Funding Targeted to Innovation

While lack of resources is not always the problem, sometimes money matters. Cases in point are the numerous federal agencies that play a key role in innovation but that are woefully underfunded. The U.S. Patent and Trademark Office (PTO) used to be the envy of other nations for its effectiveness and efficiency. But today a backlog of more than seven hundred thousand patent applications at the PTO means that most applicants will wait at least three years for a decision. Likewise, there have been increased delays at the FDA for drug and device approval and difficulties in upgrad-

ing the scientific expertise needed to expeditiously and effectively evaluate new drugs and biological submissions.⁴⁰ The U.S. Trade Representative's Office brings relatively few cases before the World Trade Organization (WTO) to challenge the mercantilist practices of other nations. And the U.S. statistical system needs to do a better job of providing the kinds of data that would help policymakers understand the true condition of the U.S. innovation system. In all of these cases, lack of funding has been the principal cause of suboptimal performance and more resources would boost performance.

Innovation Impact Analysis

Innovation is the poor stepchild of cost-benefit analysis. For more than thirty years, the OMB's Office of Information and Regulatory Affairs (OIRA) has reviewed proposed federal agency actions on the basis of cost-benefit analysis. In other words, will the agency regulation or action lead to benefits that exceed their costs? This is certainly important, but there is almost no analysis of how federal actions will affect innovation. To remedy this, Congress should establish a small Office of Innovation Review (OIR) within the OMB whose mission would be to champion innovation within these processes.⁴¹ Such an entity would add an important new voice to the regulatory conversation. There would now be an entity speaking clearly and forthrightly on the centrality of innovation. More important, the OIR would not merely have a voice: it would be able to remand agency actions that harm innovation. It would also propose regulations that foster innovation. This is no small matter. Indeed, it would change the regulatory playing field overnight.

Funding Tied to Performance

The federal government routinely provides monies to other organizations (state and local governments, educational institutions, health-care providers, and the like) to achieve some public purpose. But all too often, the accountability is process-based—did the funds get spent the way they

were supposed to?—not outcome-based. Moreover, to achieve process-based accountability, federal rules often stifle creativity and innovation in organizations receiving support. The federal government could be a catalyst for innovation if it tied its funding more closely to performance. Indeed, the federal government should explicitly use its power of the purse strings to drive innovation among the recipients of those funds. It should allocate money to agencies, departments, or other benefactors that implement innovative policies or approaches. The idea is to take the same amount of money, but allocate it as an incentive to drive performance improvements and innovation.

The Department of Education's "Race to the Top" initiative is a model for spurring organizational innovation. The department offered \$4 billion in grants to states committed to reforming their education systems. States that are unwilling to leverage data and accountability systems to improve measurable performance outcomes, that have legislation preventing the development or expansion of innovative school approaches, or that cannot demonstrate effective alliances with local teachers' unions on performance accountability are not eligible. After Tennessee and Delaware were awarded the first \$600 million, nonqualifying states worked to pass conforming legislation, including addressing long-standing union issues.⁴² "Race to the Top" should serve as a model for using performance incentives to drive innovation across a range of government agencies. For example, as noted, the federal government could make funding to universities partially contingent on how well universities commercialize their research. Likewise, the Department of Transportation could allocate funding from the Highway Trust Fund on the basis of how effectively states reduce traffic congestion.

Information Technology Transformation

One of the defining features of many of today's innovations is their basis in information technologies—computers, software, and telecommunications.⁴³ As such, economic success depends upon accelerating digital transformation and the widespread use of IT in all sectors of the economy. The United States performs well when it comes to enterprise-level adoption of

IT. However, the United States lags behind in the adoption of IT in other areas, particularly those confronted with chicken-or-egg conundrums.

One prominent example is the smart electric power grid. The smart grid is intended to be a new kind of network that will deliver power more efficiently and reliably than our existing power grid. The smart grid will facilitate the seamless integration of new technologies, including "smart" appliances that respond to dynamic price signals, plug-in hybrid electric vehicles, distributed generation (for example, residential solar panels), and energy storage solutions. However, U.S. electric utilities have been slow to embrace it, in part because as regulated monopolies they have little incentive to do so and in part because the public utility commissions that regulate them have been risk-averse. (It's made worse by neo-Luddite citizen groups that oppose smart grids on completely fallacious grounds.) And, at least until the 2009 stimulus legislation, there was little help from government.

This suggests a key role for government: supporting "digital platforms." Neoclassical economics ignores technology platforms. But throughout U.S. economic history, technology platforms have served as powerful launching pads for new industries and jobs. In the 1920s, there was no point in GE or RCA inventing a new electric appliance if people did not have electricity. In the 1950s, there was no point in Sears or Macy's opening stores in suburban shopping malls if customers could not drive on highways to get to them. In the 1990s, there was no point in Amazon.com trying to sell books online if the World Wide Web didn't exist. And in the early 2000s, there was no point for YouTube to host videos if people didn't have broadband in their homes.

Today is no different. There is no point in creating an online application to let people manage their health information if that information consists of paper records. There is no point in creating a smart washing machine that turns itself on when electricity costs are low at night if the supportive electric grid isn't smart as well. There is no point in creating mobile applications that require high transmission speeds if the 4G network is not deployed with adequate spectrum allocated to it. In fact, there are thousands of job-producing new products, services, and business models ready to be launched once the needed digital platforms are in place.

There are at least six key digital platform technologies today. The first is broadband, which is a critical enabler of a host of new applications like telehealth and cloud computing. Yet, only about two-thirds of Americans subscribe to broadband, it is not universally deployed (about 6 percent of homes have no access other than satellite), and broadband speeds, while improving, can get much faster still. One reason so few Americans subscribe to broadband is that they don't have a personal computer or don't know how to use one. Taking steps to get more than 90 percent of households online would be a significant step forward in building a universal broadband economy.

Second, next-generation 4G wireless communications promise to provide services with speeds that are twenty to fifty times faster than today's 3G networks, enabling a mobility revolution to emerge. Yet, many places today cannot even get cell phone coverage, much less advanced data services, and it is not clear that the government will free up enough spectrum, especially spectrum now used by TV networks, for these data-hungry wireless applications. Third, health IT gives patients and their caregivers an easily accessed, comprehensive view of the patient's health information. But compared to some other nations, America lags far behind.⁴⁴ Fourth, intelligent transportation systems can bring real-time intelligence to travelers. Imagine that you could get real-time, in-vehicle traffic information that dynamically reroutes your navigation route based on information such as current road conditions (e.g., avoid icy spots or that traffic accident that just occurred moments ago and is backing up the interstate). Fifth, a smart electric grid could sense the location of power outages; charge customers based on time-of-day use; and enable the use of new technologies like plug-in hybrid electric vehicles, distributed generation, and energy storage solutions. Sixth, contactless mobile payments can let consumers use their cell phone to pay a taxi fare, check in and out of a parking garage, present a boarding pass at the airport, or serve as a hotel room "key."

Without government help to catalyze deployment of these platforms, we will not see the progress that is possible. In fact, as noted previously, a key reason why some nations are ahead of us in deploying these platforms is that foreign governments have engaged in smart partnerships to help the private sector build the platforms, in part by using a combination of tax in-

centives; smart, but limited, regulations that drive change; and having the government act as a lead purchaser. The U.S. federal government should do the same.

International Framework for Innovation

Competing effectively in economics, sports, or any other area depends not only on competing at the highest level but also ensuring that the opponents play by the rules. While the United States needs to improve its innovation game, it also needs to fight more vigorously against foreign innovation mercantilism.

Indeed, it will be difficult for the United States to regain global innovation leadership if it continues to largely turn a blind eye to rampant foreign policies and practices that distort the spirit, if not the letter, of the WTO agreement, with the goal of limiting U.S. imports of high-tech products and services while promoting their exports. These countries want it both ways; they want access to the U.S. market but do not want to buy U.S.-produced goods and services. They want U.S. FDI, particularly high-tech investment, through outsourcing, joint ventures, and other types of investment, but they want to weaken the competitive advantage of U.S. companies in favor of their own. They want U.S. technology and intellectual property, but they don't want to pay for it.

For decades after WWII, the United States benignly aided the development of other countries' manufacturing and export capacity, believing that the expansion of commerce would create a bigger pie for all and that it would be years before emerging countries became formidable competitors. Well, those years have arrived. The fledglings have grown into formidable birds of prey in some cases, and the United States can either take cover or engage them as serious opponents on an equal footing.

To stop the continued erosion of America's technology leadership, the federal government will have to make fighting foreign innovation mercantilism, particularly but not solely from China, a top priority, as important as national security. Both the administration and Congress need to let countries know that they cannot expect to get the WTO's benefits if they fail to meet its obligations.

The first place to start is currency. The U.S. government needs to affirm that it will no longer defend the dollar and that it expects other nations to stop their own currency manipulation. Presidents should appoint Treasury secretaries who see their job not as “borrowers in chief” who want a strong dollar to keep their borrowing costs low, but as “defenders of a level playing field” who will publicly work to drive the value of the dollar lower. They should bar the words “defend the dollar” from all Treasury speeches, memos, and thinking. This means allowing the dollar to weaken while pressuring other nations that manipulate their currencies to strengthen theirs, at least until the United States once again achieves a balance of trade.

Fighting currency manipulation is only one component of the struggle the United States (and hopefully its like-minded allies) must engage in. The United States also needs to dramatically increase its pressure on other nations and global organizations (like the WTO) to stop the wide array of unfair trade practices targeted at boosting exports, particularly in high-value-added, innovation-based sectors.⁴⁵ These include discriminatory tariffs and taxes, export subsidies, intellectual property (IP) theft, blocking market access by foreign firms, forced technology transfer, unfair subsidies to state-owned enterprises, standards manipulation, and the use of regulations and laws (including antitrust) to discriminate against firms.

Unfortunately, all too often, U.S. agencies see the race for innovation advantage as a game in which U.S. industrial advantage can be traded away for foreign policy goals, as chapter 4 explains. Moreover, agencies like the State Department sometimes take the side of other nations, especially developing nations. The fact that there are even debates inside the State Department over whether to pressure developing nations that are stealing U.S. intellectual property (with one side arguing that doing so would hurt poor nations) suggests that the U.S. government is still not of one mind when it comes to defending America’s economic interests.

Moreover, the agency supposedly charged with defending U.S. economic interests internationally, the United States Trade Representative’s Office (USTR), suffers from two key limitations. First, its budget and manpower are too modest given today’s global trade challenges. Second, political leadership in the USTR more often than not focuses on promoting trade opening rather than on enforcing existing trade agreements. Because success for the USTR is often defined as signing new trade agreements, it has less

incentive to be a tough negotiator. You cannot win at negotiation if you need the deal more than the other guy. Different reforms to trade enforcement have been proposed, including expanding the USTR budget for enforcement, moving the enforcement function out of the USTR to the U.S. Department of Justice, or setting up the USTR as a separate agency outside the Executive Office of the President (combined with some related functions from the Commerce Department).

Wherever the USTR is situated, it needs access to more talent and resources that can help it think strategically about how trade and globalization are impacting U.S. competitiveness. The USTR is still fighting the last war—the tariff war and the war to sign trade agreements. It’s not set up, either institutionally or philosophically, to fight the current war—the war against rampant innovation mercantilism fueled by a wide array of nontariff barriers. To help address this, Congress should allocate \$5 million to create an Office of Globalization Strategy within the USTR, run by a deputy for globalization strategy. The office would be staffed by an interdisciplinary team of about twenty individuals with a diverse set of skills, including economists (as of 2011, there were only three at the USTR), policy analysts, attorneys, and so forth, experienced across competition policy, regulatory policy, standards, technology policy, and other realms. This group would be charged with systems thinking about the design of U.S. trade policy in the context of globalization to ensure renewed U.S. competitiveness.

Affected businesses must also become more willing partners in enforcement efforts. The USTR cannot bring legal actions if companies will not supply the evidence. Companies often rightly assert that they will face retaliation in foreign markets, particularly China, if they are associated with WTO actions. But unless other countries begin to honor their global trade commitments soon, the U.S. hand will become ever weaker and companies will completely cede their ability to level the playing field. One way for the government to address this challenge is to make it clear that USTR will bring cases whenever U.S. interests are being hurt, even if U.S. companies don’t want them to proceed. This policy would make it clear to countries like China that their threats to punish American firms for bringing cases won’t work.

Beyond facing retaliatory threats, there are two other reasons why U.S. companies don’t bring more trade enforcement cases. First, they are

expensive. Second, the "free rider" problem means that companies can benefit if they can convince other firms in their industry to bear the burden of helping the USTR to bring a trade case. In order to remedy this, Congress should encourage companies to build WTO cases by allowing them to take a generous tax credit for expenditures related to bringing the cases.⁴⁶

One other area the United States must better compete in with regard to international trade is by providing increased export financing assistance to U.S. exporters. As a share of GDP, competitors such as Brazil, China, India, France, and Germany provide seven to ten times more export credit assistance than does the United States.⁴⁷ (In fact, as a share of GDP, in 2008, China provided seventeen times more export credit assistance to its exporters than the United States did.) To address this, Congress should expeditiously reauthorize funding for the U.S. Export-Import Bank, which provides export credit financing to U.S. businesses, while increasing the statutory lending authorization of the bank from \$100 billion to at least \$160 billion. Furthermore, Congress should allow the bank to use \$20 billion in unobligated authority to lend directly to domestic manufacturing companies that are in competition with subsidized competitors and can demonstrate that the funds would support expanded manufacturer activities in the United States.

A final component of the international issue is high-skill immigration. Talent is a key resource in the global knowledge economy.⁴⁸ High-skill immigration plays a critical role in contributing to a country's knowledge and skills pool. The United States has benefited immensely from attracting foreign-born talent. For example, at least seven studies have examined the role of immigrants in launching new companies in the United States, and all conclude that immigrants are key actors in this process, creating from 15 percent to 26 percent of new companies in the U.S. high-tech sector over the past two decades.⁴⁹ While many nations, such as Canada, have implemented explicit strategies to attract internationally mobile skilled workers, the United States has a de facto low-skill immigration policy.⁵⁰ To change that, Congress should provide automatic permanent residency status (green cards) for foreign students who graduate with a master's or Ph.D. degree in STEM fields. We should also create a system whereby fees for

H-1B visas (a nonimmigrant visa that allows a U.S. company to employ a foreign individual for up to six years) float directly with the unemployment rate, with H-1B visa fees being low when unemployment rates are low and vice versa.

Recognizing that the United States is falling behind in the race for global innovation advantage is hard; developing the political will to take action is even harder. However, there is no reason the United States has to succumb to the same malady its British cousins did. While America often avoids action on problems for much too long, as Churchill once said, "The Americans will always do the right thing . . . after they've exhausted all the alternatives."⁵¹ Certainly there will be deniers, resisters, and opponents, as there are now, but it's also likely that there will be increasingly vocal calls for action. If a growing consensus develops about the nature of the problem and the need to act, this ultimately could get translated into political action. But developing this consensus for action will require a better understanding of the political economy of innovation.