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## Building a Long-Term Strategy for Growth through Innovation

BY MARTIN BAILY, BRUCE KATZ AND DARRELL WEST



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**H**istory has amply demonstrated that innovation in the public and private sectors is the most important key to long-term U.S. prosperity and economic competitiveness. Yet in the United States today, innovation is at risk of stalling just at a time when rising international competition is on the upswing and the U.S. economy is still reeling from a deep recession.

Priorities for action start with turning three deficits—budget, investment/savings and trade—into surpluses.

This will require action by the public sector—to provide tax credits for innovation and more forward-thinking trade policies, for example—and the private sector, including businesses, universities and private research firms that reward education and job skills.

To achieve solid, sustainable economic growth, government agencies at all levels must integrate and coordinate their activities with each other and with the private sector, rowers pulling in the same direction in a sea of economic uncertainty.

## Preface

Our goal for the Brookings's Growth Through Innovation (GTI) initiative has been to explore how we could think about a plan for national economic competitiveness. In particular, we have sought to address whether, in an era of both intense political partisanship and a yawning divide between government and business, we can conceive of non-partisan approaches to our common problems. In this strategy paper, we chart a means for political leaders—federal, state and local, both liberal and conservative—to work constructively in partnership with industry to foster economic growth and job creation. Our key premise, if the past is prelude to the future, is that innovation is the vital spur to growth and prosperity, and we fear that the United States risks losing its comparative advantage as the epicenter of global innovation.

Our message is straightforward: We need to foster an economy driven by innovation, exports, opportunity and clean energy. This will require us to invest in human capital and infrastructure; to adopt new regimes for trade, patents, immigration and technology transfer; to devise methods for government to work more effectively, and to restore fiscal sanity to our budget and debt policies.

In preparation of this work, we assembled on three occasions an extraordinary group of leaders from the private and public sectors to explore these matters. They came from our most important industries: information technology, communications, media, manufacturing, resources, defense and green technology. We also consulted with public-sector leaders who have grappled with our most vital public policy questions—and have the scars to show for it. We then turned to a group of Brookings's leading scholars—Martin Baily, Bruce Katz and Darrell West—to compose this paper based in part on their own path-breaking research but also profoundly

informed by what we learned from each other in our meetings.

We believe this strategy paper combines the best of the insights from Brookings's top scholars and the real world experiences of business and civic leaders.

The economic problems this paper addresses are manifest, urgent and not necessarily susceptible to quick fixes. In fact, economic historians warn us that, in the aftermath of debt-fueled bubbles, countries often experience persistently high unemployment and low growth for a decade or more. To avoid that fate, we must work in earnest to construct ways to put the millions of unemployed and underemployed Americans back to work. That means we have to devise innovative strategies to elevate our nation's economic output to its potential, which by some estimates could be as much as \$1 trillion greater than it is today. Clearly, this must be driven by innovation at all levels. It must be accomplished by advances in basic science, technology, industries of the future, process efficiencies and revolutionary business models, and it must be supported by innovations in capital formation, improved delivery of public services and fresh approaches to institutional governance.

Political operatives frequently tell us that partisanship and paralysis mean that thoughtful solutions to critical U.S. problems are not possible. We find that mind-set unacceptable. Instead, we believe that Americans are prepared to meet these challenges, just as we have met other great challenges throughout our history. And those business executives, public-sector leaders and scholars who collaborated on this initiative have demonstrated their readiness to do their part. We believe they are representative of many other public- and private-sector leaders likewise prepared to help.



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We are also often told that industrial policy—“picking winners”—is folly in a market economy. That misses the point. Every high-growth country in the world today is implementing a carefully conceived, long-term plan to create the conditions for national economic competitiveness and prosperity. This does not at all mean tampering with the market’s allocation of resources. Rather it means creating a foundation upon which markets can function and business can thrive.

Brookings is uniquely capable of creating a forum like GTI where partisan political differences and commercial self-interest can both be set aside in the pursuit of the common good. This combination of research, private dialogue, public discussion and erudite publications is our hallmark. In addition to the Brookings scholars who composed this strategy paper, I’d especially like to thank my fellow Brookings

Trustees who served as co-chairs in this effort: John Thornton, Steve Denning, Ann Fudge, Klaus Kleinfeld and Dominic Barton.

One can argue that our problems are the culmination of a generation of both the accumulation of debt and the neglect of basic investments in almost every sector of our society. If so, the solutions also could well require decades of remediation. To some, this challenge appears onerous and interminable. Why not, as they say, just kick the can down the road? The sense of urgency and resolve among those who have been a part of GTI so far suggests that further delay will be unacceptable. The moment for action has come.

**Glenn Hutchins**  
*Brookings Trustee*  
*Co-Founder and Co-CEO, Silver Lake*  
*May 2011*

## Summary



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**Darrell M. West** is vice president and director of Governance Studies and founding director of the Center for Technology Innovation at Brookings.

A number of immediate actions to jump-start progress toward healthy economic growth are possible, but much long-term heavy lifting will remain. Aligning those long-term needs with clear overall growth goals provides focus for policymakers and the opportunity to build support within government, in the private sector and with the public.

### Policy Recommendations:

Federal, state and local governments can take key short-term and long-term steps to achieve these goals:



#### Put the Federal Budget on a Sound Footing:

*Fiscal, investment and trade deficits are unsustainable weights on our economy*

- **Short term:** Cap or eliminate tax expenditures, such as the mortgage interest deduction
- **Long term:** Implement the recommendations of the Bipartisan Commission on Fiscal Responsibility and Reform, including significant tax reform



#### Prioritize Economic Drivers:

- **Innovation Fueled: Taking advantage of technology**
  - **Short term:** Support basic scientific research by extending the R&D tax credit
  - **Long term:** Create a better system for commercializing research from universities
  - **Long term:** Streamline the process for approving patents
  - **Long term:** Step up the enforcement of intellectual property protection, especially overseas
- **Export Oriented: Seizing the opportunities of world markets**
  - **Short term:** Ratify new trade agreements in Asia and Latin America

- **Long term:** Consolidate federal support for manufacturing research into a single Manufacturing Innovation Fund
- **Opportunity Rich: Investing in intellectual capital**
  - **Short term:** Double the number of H-1B Visas
  - **Long term:** Establish national postsecondary goals and create a performance measurement system to support the effective use of federal resources
  - **Long term:** Double federal support for community colleges, using metrics to award additional money
- **Low Carbon: Helping promote energy security and sustainability**
  - **Short term:** Create and fund a network of energy discovery institutes at leading research universities
  - **Short term:** Authorize a National Infrastructure Bank to promote investment
  - **Long term:** Authorize a Green Bank; Fully fund and implement the Green Bank and Infrastructure Bank



#### Emphasize Effective Government:

*Integrate policy action*

- **Short term:** Achieve cost savings through the use of digital technology by public-sector agencies
- **Short term:** Use social networking technologies to increase communication between citizens and government
- **Short term:** Pass congressional legislation improving privacy and security designed to safeguard innovation in health care, education, energy efficiency and public sector performance
- **Long term:** Create regional business plans to guide policies across different levels of government

## Why Innovation Action Is Needed Now

Innovation is the most important key to long-term prosperity and economic competitiveness. In the aftermath of World War II, the United States faced a global economy in ruins, a costly arms race and, later, a space race with the Soviet Union. In response, the country turned to its unique and historic reliance on invention and opportunity. Both the private and public sectors responded by taking on a series of urgent actions and long-term investments. They made a priority of the physical and human infrastructure needed for the economy to grow. The nation brought leading scientists from around the world to America and supported their basic and applied research. And it embraced the competition that came from open markets at home and abroad.

The results were spectacular. The United States became the unchallenged world leader in science and technology and, once the Soviet Union collapsed, the sole global superpower. The country's leaders inspired construction of an interstate highway system that allowed new economic opportunities to spill forth in all areas of the country. They improved financial aid for college students and invested in scientific research. Not only did efforts like these enable the United States to become the first nation to put a man on the moon, they laid the groundwork for the commercialization of satellite communications, global positioning systems and wireless communications. American scientists undertook basic work in computer science, materials sciences, genomics, neuroscience and cognitive science that launched new industries and created vast wealth. Digital technology and the life sciences spawned the computer revolution, new medical treatments and the deciphering of the human genome. Similar to the electric grid of the early 20th century and the interstate highway system of the mid-20th century, the Internet became an infrastructure platform for education, health care, energy efficiency, communications and mass entertainment.<sup>1</sup>



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Yet while these advances fueled growth over the past 60 years, U.S. world standing today is beset by serious challenges. First, its growing fiscal, investment and trade deficits are approaching—or have reached—unsustainable levels. Second, the core drivers of the economy are stuck in neutral, particularly those policies that would allow the most innovative companies and industries to surge forward. Third, governments—local, state and national—are not effectively working together to do what needs to be done.

The remainder of this paper will lay out a set of specific forward-looking policy actions that will foster innovation and increase our nation's productivity. These steps, along with measures to put federal deficits and debt on a sustainable path, will promote robust broadly shared economic growth in years to come. Of course, other government policies can and will affect the growth of the economy over time, including monetary and fiscal actions aimed directly at supporting the economic recovery and changes in the regulation and oversight of financial markets and products.

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Metropolitan regions are the engines of our economy—the sites of new technological breakthroughs, the export hubs that connect U.S. companies to the global economy, and the impetus for a necessary revolution in the use of energy nationwide.

## Vision of the Next Economy

Our vision of the next economy focuses the United States on turning three deficits into surpluses. It begins with addressing the budget deficit, which has received appropriately close scrutiny. But it also extends to addressing the investment/savings and trade deficits, neither of which has received as much attention as it deserves.

At the same time, the nation needs to jump-start four key drivers of economic growth that, in turn, can reduce one or several of these three deficits. First, the United States must continue to build upon its strengths as a leading source of innovation, particularly through its world-class research institutions and universities. Commercializing that research, particularly in the area of energy, will allow the nation to lead the world's shift toward a low-carbon future. In order for the benefits of U.S. innovation to be broadly shared, exports must increase and new domestic industries must emerge that serve the demands of a global middle class. In addition, the next economy must be more opportunity-rich than the last, which will require investments in human capital that will produce the next generation of American inventors, entrepreneurs and citizens.

The next economy will require an integrated strategy among all levels of government and the private sector. It must marry an effective and efficient federal government with state and local authorities, private-sector leaders and civic and philanthropic networks within metropolitan areas. Metropolitan regions are the engines of our economy—the sites of new technological breakthroughs, the export hubs that connect U.S. companies to the global economy, and the impetus for a necessary revolution in the use of energy nationwide.<sup>2</sup> Nearly all communications infrastructure is provided by the private sector in regional blocs; roughly half of the transportation infrastructure is maintained by local authorities; and nearly 90 percent of spending on education is by local government. The innovation hubs of cities alone, however, are insufficient to promote the necessary

transformation of the American economy; innovators must be supported by national and international policies that facilitate investment and job creation.



### Put the Federal Budget on a Sound Footing

**Large fiscal, investment and trade deficits are unsustainable weights on our economy**

The United States faces three related deficits. First, the well-known budget deficits of federal, state and local governments are unsustainable. Second, an investment deficit has arisen, in large part because of extremely low levels of household savings prior to the recent recession. Going forward, families will have to save more to contribute to investment and economic growth in the country as well as to ensure their own retirement security. Third, the country has an enormous trade deficit driven (among other reasons) by massive imports of oil.

As a result, the United States has a major current account imbalance. Other nations, particularly China but also Japan, are using their large trade surpluses to purchase U.S. securities. By accumulating vast reserves of U.S. dollars, these East Asian economies have fostered enormous imbalances in the global economy and the global financial crisis has exposed these unsustainable divisions between international lenders and creditors.

Avoiding a new crisis requires restoration of sanity to all three U.S. accounts and reducing their deficits to the maximum extent possible.

Setting a process in motion now that will result in lower U.S. budget deficits over the next few years is essential, in order to create room for the productive investment necessary to achieving our vision of the next economy.

**In the short term,** government must take steps to simplify the tax code in ways that broaden the base, reduce marginal tax rates, incentivize investment and impose a tax on consumption—particularly the consumption of high-carbon energy sources. The current byzantine tax system is extremely inefficient and not only creates headaches for small businesses and investors, but more important, reduces the international competitiveness of the entire economy. The federal tax code is replete with provisions that promote consumption rather than incentives that catalyze production. The worst offender—the federal mortgage interest deduction—is the second-largest federal tax expenditure and is scheduled to grow steadily over the next five fiscal years. This deduction fuels the kind of fragile economy the nation is just emerging from rather than the next economy that we seek to create. It spurs overconsumption of housing and sprawling suburbs rather than productive investment and lower-carbon urban development. It primarily benefits high-income taxpayers<sup>3</sup> and large metropolitan areas in California and the Washington, D.C.-to-Boston corridor.<sup>4</sup> The single act of capping this deduction at current levels would save \$166 billion over the next five years and would contribute mightily to deficit reduction and innovation investment.

**Over the long term,** Congress and the administration must tackle the structural features of the budget that threaten the nation's future economic prospects. The report of the President's Bipartisan Commission on the Deficit is a substantial contribution to this endeavor. The commission proposed a comprehensive overhaul of the federal tax system, which included eliminating \$1.1 trillion of tax expenditures, or at least modifying some of the largest items. It proposed cuts in military spending, raising the retirement age for Social Security, enacting significant cost containment in health care and raising Medicare premiums for those able to afford them. Assuredly, significant entitlement reform to reduce mandatory public spending is a necessary, painful step to restore our nation's fiscal health.



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## Prioritize Economic Drivers

### Competitive economies innovate, export, invest in their people and use lower-carbon energy sources

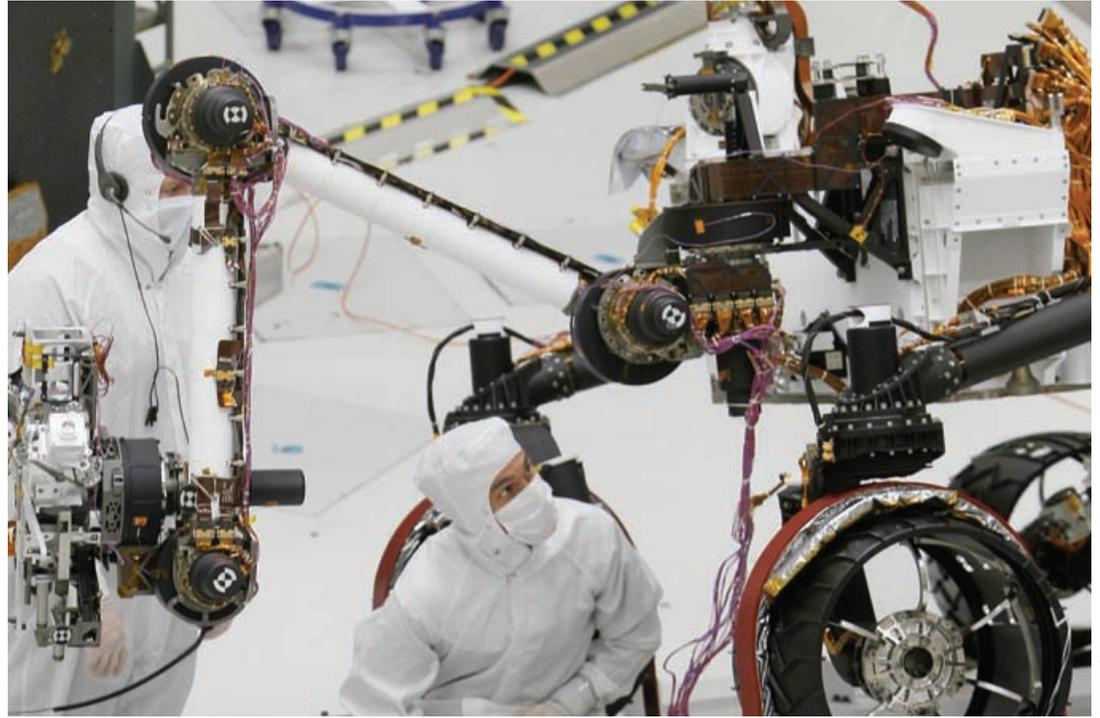
In today's world, the success or failure of modern, advanced economies depends on at least four factors. Their ability to:

- continuously innovate;
- export goods and services;
- provide opportunities for their citizens to advance in society; and
- reduce imported energy as a share of their trade balance.

With respect to the last point, success will further depend on developing an array of reliable energy sources that do not pose health and safety risks to their publics.

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A host of policy discussions and recommendations have focused on each of these topics over the years. Indeed, the four areas are research priorities across Brookings and our colleagues have produced a diverse range of proposals related to each of them, as have other scholars and research organizations across the country. These economic drivers, unlike federal tax policy, are the responsibility of multiple actors at the federal, state, local and private-sector levels, usually within a metropolitan network.

### **Economic Growth Must Be Innovation Fueled<sup>5</sup>**

Innovation is the key to economic growth and an improved standard of living, and it has driven almost all U.S. economic growth since the Industrial Revolution.<sup>6</sup> “No amount of savings and investment, no policy of macroeconomic fine-tuning, no set of tax and spending incentives can generate sustained economic growth,” says economist Paul Romer, “unless it is accompanied by the countless large

and small discoveries that are required to create more value from a fixed set of natural resources.”<sup>7</sup>

The United States faces serious new challenges to innovation. U.S. shares of worldwide total domestic R&D spending, new patents, scientific publications, researchers, and new bachelor’s and doctoral degrees in science and engineering all fell between the mid-1980s and 2000. The United States ranks only seventh among OECD countries in the percentage of its GDP devoted to R&D expenditures<sup>8</sup> and ranks 33rd in the percentage of 24-year-olds with a math or science degree, among the 91 countries for which data are available.

Historically, publicly supported institutions, such as research universities, have been the primary source of scientific research in the United States. The National Science Foundation, the Office of Science in the Department of Energy (DOE) and the Commerce Department’s National Institute of Standards and Technology (NIST) were slated for increased funding in past federal budget proposals

and the economic stimulus package (the American Reinvestment and Recovery Act [ARRA]) included a temporary boost in funding for R&D. However, increases in support for scientific research must be provided on a consistent, long-term basis to maximize their impact and encourage new investigators to pursue research careers. There is a clear economic case for support for basic research and the United States would be foolish to surrender its supremacy in this area.

**In the short term,** Congress should make permanent the research and development tax credit for private companies investing in innovation. While we generally believe reducing tax expenditures is important, in this case the need to promote the research and development that is the seed-corn on which a future crop of innovation, manufacturing and exports depends. As the nation grapples with its budget deficits, the private sector must play a larger role in supporting basic research and development and this tax credit is one of the most important ways the federal government can encourage it to do so. The tax credit is currently renewed annually, which does not allow companies the certainty to plan for long-term investment decisions.

Private-sector companies must prioritize innovation as the driver of long-term value. They should tie executive compensation to performance and promote strategic investments rather than short-sighted pursuit of quarterly earnings. Companies also should create real risk for executives with a pattern of underperformance in order to promote better corporate leadership.<sup>9</sup>

**Over the long term,** several actions would facilitate innovation. U.S. universities must do a better job of moving more quickly from basic research to commercial applications.<sup>10</sup> Faculty incentives and university resource allocation need to become better aligned to encourage technology transfer and commercialization. University licensing offices should speed up their review processes and chief technology officers should be recruited and compensated

in ways that encourage and reward innovation. Universities should consider profiting from inventions, not just through royalties and licensing fees, but equity stakes in new companies. There should be greater transparency in federally funded grant activities in terms of how faculty members maximize impact and commercialization. This would allow universities to secure new sources of revenue during a period of constrained budgets for higher education.

Federal trade facilitation programs should be consolidated into a single entity (through a “Manufacturing Innovation Fund” perhaps) that would provide substantial grants on a competitive basis to companies for innovation projects. The level of funding could be increased compared to the programs it is replacing, pushing the total funding available up to, say, \$15 billion per year. Some part of the funding would be given in the form of angel investments to start-up companies with good ideas. Some part would go to small companies that had proven the viability of a new technology but lacked the resources to scale up. Funds also would be available for established companies with plans to develop new products or new or substantially improved processes. This is not to suggest preserving failing enterprises or to put the government in the position of picking winners and losers. It would provide new funding for innovative manufacturing projects selected through peer review by business experts with practical experience.

The U.S. patent system needs a dramatic overhaul. Some 700,000 patent applications await approval in a cumbersome process that, for most applicants, takes three years or more. This slows the introduction of new products and makes it difficult for inventors to protect their intellectual property. The Patent Office has not organized its records in a way that allows an easy search for existing patents, permitting opportunists who do no research themselves to buy up portfolios of patents so they can demand fees from innovative companies. Because salaries of federal patent examiners are not competitive with their private-

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Exporting forces companies to adapt to more rigorous competition and promotes “learning-by-doing,” which sparks additional innovation.

sector peers, the agency struggles to attract talent and has limited capacity to address the application backlog. Recent Senate-passed legislation begins to address these issues and additional support could achieve greater efficiency.

Lax enforcement of intellectual property laws also contributes to the dysfunction of the patent system. Leading corporate executives, such as Microsoft CEO Steven Ballmer, have complained about the U.S. competitive advantage that is lost due to theft of intellectual property abroad. Unless the United States addresses this issue, its many inventors will not receive fair compensation for their successful innovations.

### **Growth Should Be Export-Oriented**

A large body of empirical and theoretical economic literature links trade to economic growth.<sup>11</sup> Many products with large upfront costs simply could never be profitable if not for vast international markets that allow manufacturers to reduce per-unit production costs and recoup their investments.<sup>12</sup> Exporting forces companies to adapt to more rigorous competition and promotes “learning-by-doing,” which sparks additional innovation.<sup>13</sup>

But the United States lags on exports. According to the Economist Intelligence Unit, exports made up only 12.7 percent of U.S. GDP in 2008, compared to 35.8 percent in China, 35.1 percent in Canada, 23.5 percent in India, 14.5 percent in Europe and 17.6 percent in Japan. As Howard Rosen of the Peterson Institute recently summarized, only 4 percent of U.S. companies export. And, less than 0.5 percent of U.S. companies operate in more than one country.<sup>14</sup>

It has been years since the United States ratified a major trade agreement designed to open up markets. Rather than facilitating international exchange of goods and services, there have been moves to protect domestic industries and shield key sectors from international competition. This lowers the efficiency of global trade and makes it difficult to build trading relationships.

Although U.S. manufacturing has lost jobs across the board and lost capacity in some areas, it is far from a hopeless case. The two charts on page 11 illustrate both the strength of the important high-tech sector and its need to reorient toward exports. The first chart shows that in this manufacturing sector, the United States maintained its share of global value-added surprisingly well through 2007. It has done much better in fact than Japan, although China, no surprise, is moving up rapidly and gaining share.<sup>15</sup> The second chart shows the dramatic decline in the U.S. share of high-tech exports. In short, the continued strength in production has not translated into the same strength in selling overseas.

Building on these core strengths, exports can be a critical component of economic recovery, as demand for American-made goods in emerging markets is surging, while demand at home remains tepid. Over the long term, exports will be just as important, given the rising middle class in developing nations and the tendency of exporting firms to offer higher pay and benefits to workers at all skill levels. Simply put: More exports means more jobs. Brookings research shows that for the average metropolitan area in 2008, 5,800 jobs supported every \$1 billion in exports.<sup>16</sup>

At present, several government programs support innovation and technology development, including NIST’s Technology Innovation Program and Manufacturing Extension Partnership. In addition, there is the R&D tax credit that is renewed each year, that, as noted above, should be made permanent.

U.S. trade policies suffer from significant shortcomings. Current federal efforts at trade facilitation, for example, are often not well conceived or implemented. Some of this stems from a historic and well-placed aversion to “industrial policy,” which allowed the U.S. economy to avoid the problems faced in Europe, as governments propped up failing businesses and slowed down the process of economic adjustment.<sup>17</sup> Nevertheless, increased public-private partnerships to encourage trade in selected sectors are both possible and desirable.

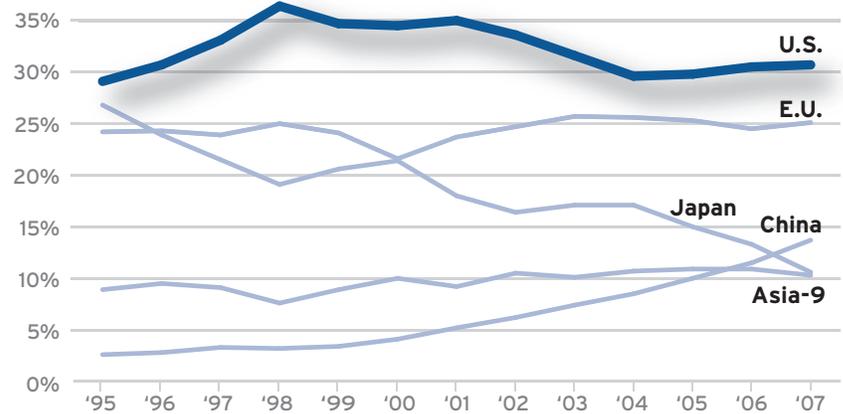
Under current federal programs, projects are not selected by independent experts, skilled in technology and business and paid appropriately for their services. Funds tend to be provided as relatively small grants, as opposed to loans with repayment terms geared to the type of company and project being funded. Recipients could be provided greater encouragement and advice on obtaining private funding, in addition to the loans. Funding options would include bank lending, private angel investments or venture capital. The chance of commercial success and a solid expected rate of return should be the most important criteria in selecting projects to support. That will require a change in the U.S. culture of export promotion.

For their part, state and local governments need to do a much better job of promoting a cluster-based approach to economic development, as there is evidence that clusters enhance development.<sup>18</sup> Firms established in close proximity to exporting firms experience faster productivity growth.<sup>19</sup> States can provide rich, comparable data sets to help metropolitan areas quickly understand market strengths. They can provide small investments in regional capacity, such as cluster grants. Perhaps most critically, states can break out of agency silos that no longer match economic or geographic realities and create cross-agency teams that focus on delivering what regions say they need to succeed.<sup>20</sup>

Based on this assessment, several actions would open up markets and boost trade.

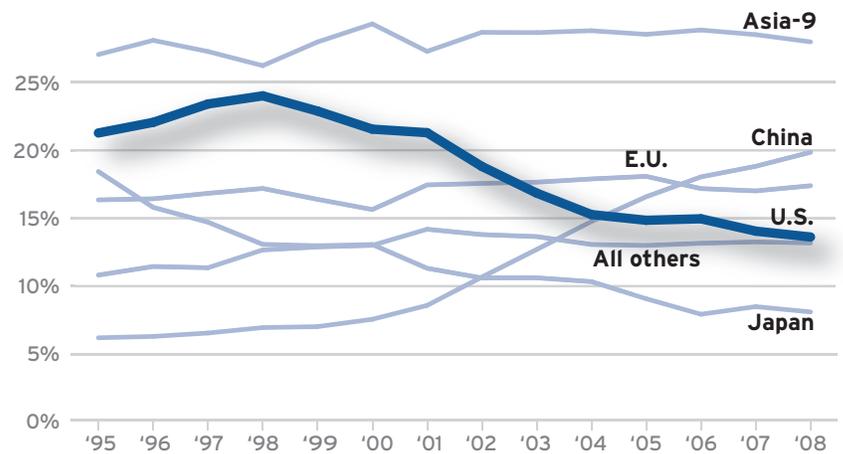
**In the short term,** the United States should send a message that it is again ready to make international trade a priority. Trade agreements have been signed with South Korea, Colombia and Panama, but Congress has not yet approved them. It is crucial for the United States to solidify trade with growing countries in Asia and Latin America. These are the places where much of the planet's population growth is taking place and where economies are rising. Congress should ratify these agreements in order to boost manufacturing, improve exporting and create needed jobs.

Share of Global Value Added of High-Tech Manufacturing Industries: 1995-2007



Source: National Science Board Science and Engineering Indicators

Share of Global Exports of High-Technology Products: 1995-2008



Source: National Science Board Science and Engineering Indicators

...upgrading the education and skills of the diverse U.S. workforce is no longer just a matter of social equity. It is fundamentally an issue of national competitiveness and national security.

**Over the long term**, the United States should work to relaunch the Doha Round trade negotiations. Concluding the Doha Round would provide a needed boost to the global economy (with an estimated 0.4 percent boost to U.S. GDP) and allow trade negotiators to pursue greater openness in the trade of services, a competitive sector for many U.S. exporters. It would also allow the United States to reduce agricultural subsidies that distort the domestic economy and increase the costs of agricultural commodities worldwide.

### **The United States Must Be Opportunity Rich**

Human capital is at the core of a productive economy. A highly educated and skilled labor force drives innovation and production and it is a prerequisite for income growth, upward mobility and access to opportunity. At present, the United States is falling behind other nations in educating its citizens. In the decades ahead, upgrading the education and skills of the diverse U.S. workforce is no longer just a matter of social equity. It is fundamentally an issue of national competitiveness and national security.

At a time of high unemployment, the nation's need for more hiring is extraordinary, but unfortunately, there is a profound disconnect between the needs of an innovation-fueled, export-oriented economy on the one hand and the needs of the unemployed on the other. The country needs scientific innovators who start new businesses and create high-paying jobs. And it needs well-trained, technically competent workers to manage and staff those firms.

An innovation-driven economy will demand and reward more education and skills. The new economy will require workers to be better educated when they enter the workforce and to continually upgrade their skills throughout their working lives. Greater human capital leads to higher output per worker (e.g., by improving worker efficiency or by growing and retaining jobs in high-value indus-

tries) and it also may create spillovers, such as raising the rate of innovation. It should also create more opportunities for workers to move into well-paying jobs with secure benefits. Providing greater access to post-secondary education and improving the performance of educational institutions will be essential as the nation shifts toward the next economy.

Just as the country invested in science fields following the shock of the Soviet Union's 1957 Sputnik launch, America again needs to invest additional resources in basic sciences. This includes research and development money for higher education, improved support for graduate students seeking advanced degrees in science and engineering, and improving the training of high school science and math teachers through the development of programs such as a master teacher corps.

We should not limit the search for talent to those whom we are able to raise and educate by ourselves. In the years leading up to World War II, the United States recruited Europe's top talent for our nuclear program. Scientists such as Albert Einstein, Enrico Fermi and Edward Teller immigrated to America and played instrumental roles in securing our country's future and developing its nuclear advantage.<sup>21</sup> Today, we need to think about a new "Einstein Principle" for our immigration policy. We should elevate brains, talent and special skills to a higher plane, in order to attract more individuals with the potential to enhance American innovation and competitiveness, increasing the odds for economic prosperity down the road. Much of the high-tech boom of recent years has rested on immigrant entrepreneurship, as a quarter of the technology and engineering businesses launched in the United States between 1995 and 2005 had a foreign-born founder. In Silicon Valley, that proportion was over half.

Right now, only a small number of U.S. visas are set aside for employment purposes. Of these, some go to seasonal agricultural workers while a small number of H-1B visas (65,000 per year)



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Today, we need to think about a new “Einstein Principle” for our immigration policy.

are reserved for “specialty occupations,” such as scientists, engineers and technological experts. The current number reserved for scientists and engineers is two-thirds of that allowed between 1999 and 2004.

As we move from lead innovators to workers, we must continue to insist on high skills. Manufacturers look for high-ability math, science and engineering graduates; such individuals provide a catalyst for manufacturing jobs. Specialty high schools are one way to increase the flow of high-ability students into technical fields. (Students in these high schools cover curricula that go well beyond that taught in regular high schools).

But policy also must pay attention to Americans still seeking work. Though recently the country has experienced modest job creation, with more than 244,000 private-sector jobs created in April 2011, for example, that number will need to double every month for the next two years to return to unemployment rates below 7 percent.

Moreover, U.S. workers at the low end of the education spectrum have experienced little to no wage growth since the mid-1970s. Workers without a high school diploma saw their real average hourly wage drop from 1975 to 2005 and those with no more than a high school diploma saw only a marginal increase. By contrast, those with a four-year or advanced degree experienced significant real wage growth over this period. Only the most highly educated workers have experienced any real wage growth since the late 1990s.<sup>22</sup>

The recession has, not surprisingly, made things worse for less-educated workers. The unemployment rate for all Americans over age 25 has gone from 3.9 percent to 7.4 percent from the start of the recession until today. But for people without a high school diploma, the unemployment rate leapt from 7.8 percent to 13.7 percent. For those with only a high school diploma, the unemployment rate rose from 4.7 percent to 9.5 percent. By contrast, workers with a bachelor’s degree had a very small increase in unemployment, from 2.1 percent to 4.4 percent.



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Good community colleges work closely with local employers to ensure the training they provide matches the needs of area workplaces.

The National Association of Manufacturers has identified community colleges as the place where production workers can receive training in modern manufacturing techniques. Nearly six million students enroll in these colleges and most of them are taking classes in practical, job-related skills. Good community colleges work closely with local employers to ensure the training they provide matches the needs of area workplaces. Community colleges also can provide remedial learning for students who did not acquire adequate reading, writing and math skills in high school.

Additional federal funding for community colleges can be money well spent, if it helps increase the pool of skilled workers available to manufacturers. There should also be a sustained effort by state and county governments to improve the quality of community colleges. Many classes do not provide high-quality instruction, some of the colleges are badly operated and, in some, dropout rates are high.

Support for two-year institutions is critical to increasing manufacturing and therefore export, competitiveness. Sara Goldrick-Rab and her co-authors explain that, "To maintain the nation's competitive advantage in manufacturing, continued rapid productivity growth is essential. The skills obtained through community college education can contribute to that productivity growth. . . . [C]ommunity colleges provide the types of formal training that are increasingly necessary for jobs in advanced manufacturing involving complex, high-tech equipment."<sup>23</sup>

Federal policy gives 300 percent more support, per full-time equivalent (FTE) student, to four-year institutions than to community colleges, \$2,600 vs. \$790 respectively.<sup>24</sup> In total, federal funds (including financial aid) amount to only 15 percent of community college revenue.<sup>25</sup> The federal government does invest in community colleges in other, indirect ways. For instance, the ARRA included \$3 billion for Workforce Investment Act (WIA) programs, a portion of which will likely be administered through community colleges. But a community college education involves more than just short-term programs, generally the WIA's focus.

The economic downturn heightens community colleges' need for federal assistance. Enrollments are up, as displaced workers enroll for new training and high school graduates seek more education before entering the labor market. But state and local financial support is either down or unreliable, given shrinking state and local revenues.

In short, a number of specific policy actions would boost the education and skills of the U.S. workforce. These include improving science, technology, engineering and math training, increasing aid to community colleges and expanding opportunity for U.S. workers with the fewest skills, as well as international workers who are highly skilled.

**In the short term:** As recently as 2004, the United States granted 195,000 H-1B visas each year, in order to foster long-term economic development. The United States should at least

return to those levels today and perhaps even increase them. That would signal world employment markets that the United States is putting performance over other considerations in the race for economic productivity.

**In the long term**, government at all levels needs to invest in basic training and a better match between skills development and workforce needs. A sustained commitment to workforce development—through support for internships and apprenticeship programs—would improve the preparedness of our labor force and provide a path for unskilled workers to increase their productivity. Government needs to make this a priority and can start by establishing national postsecondary goals and creating a performance measurement system to support the effective use of resources.

Governments should incorporate career and technical education into curricula for secondary education, including a broad expansion of specialized math and science high schools. At the regional level, employers and educators should collaborate to ensure that students are being equipped with the necessary skills to support the needs of local businesses and industries.<sup>26</sup>

We believe that the greatest bang for the buck is to support community colleges. To bolster community colleges, expand opportunity and support manufacturing competitiveness through better-trained workers, the federal government should:

- Double its current level of support in order to account for more than 10 percent of community colleges' budgets, ultimately awarding three-quarters of these funds based on colleges' performance in meeting key goals around student credits, credentials and degree completion;
- Stimulate instructional innovations and practices to increase the quality of community

college education, by devoting half of all resources in the administration's proposed \$2.6 billion state-federal partnership fund to improve and evaluate practices enhancing sub-baccalaureate education; and

- Support the improvement of student data systems necessary to measure and track college student outcomes, to guide funding, improve accountability and promote continuous improvement in educational quality.

### **Accelerate the Move to Low-Carbon Energy<sup>27</sup>**

The world economy is moving away from carbon-based fuels and toward new sources of energy, driven in part by state, national and international goals.<sup>28</sup> And as reflected in the current U.S. accounts imbalance, dependence on foreign oil undermines the sustainability of the nation's economic model. Narrow and politicized discussions of the impacts of cap-and-trade regimes or of green jobs have obscured how profound and market-driving this transition will be. As several recent environmental incidents have reminded us, no source of energy is without serious risks. But shifting to newer, cleaner and more secure sources of energy will affect the houses we live in, the cars we drive, the products we buy, the shape and location of our communities and how we get from one place to another.<sup>29</sup>

The changes would extend beyond sources of fuel to the appliances, computers, houses and vehicles that use energy and the roads, bridges, rail-lines, communications technologies and power grids that transport people, goods, services and power itself. Today's federal infrastructure policy hinders the shift to the next economy. The transport networks in the United States are clogged and congested and the nation's infrastructure as a whole is third-class. The public sector is unlikely to provide the necessary capital to rebuild this crumbling infrastructure without significant institutional reform. But the country cannot afford to wait.

...shifting to newer, cleaner and more secure sources of energy will affect the houses we live in, the cars we drive, the products we buy, the shape and location of our communities and how we get from one place to another.

Our national energy policies must be transformed in order to deliver the technological breakthroughs needed to respond adequately to the nation's energy supply, infrastructure security and sustainability challenges.

Both the private and public sectors are making only incremental strides to move to a less carbon-intensive economy. On the private sector side, several companies have begun to target environmentally conscious consumers. Electric and hybrid vehicles, wind and solar power and energy efficient appliances all have found customers. But these efforts are sporadic and their popularity tends to track more closely with the rise and fall in the price of energy than with a general rise of consumer demand. The one exception to that is the increasing shift to natural gas for power generation, which has been driven by next-generation drilling technologies and the uncertainties surrounding other major fuels, such as coal and nuclear.

Almost without exception, industry leaders have not waited for favorable government regulation, but have sought to expand their businesses based simply on current markets. However, nearly all of them increasingly say the federal government needs to engage more aggressively to help them deal with rising foreign competition and maintaining export opportunities. Moreover, they rightly argue that the current lack of a price on carbon means that the full external costs of carbon are not being accounted for.

The federal investment in energy R&D today amounts to a bit more than \$2 billion per year—less than one-fifth of the funding levels of the 1970s and 1980s. Today's investments in energy R&D by the federal government and large industrial firms are only one-fifth of those of the early 1980s. They make up just 1.1 percent of the nation's total R&D investment and 0.03 percent of the nation's GDP.<sup>30</sup> The energy industry lags most other major U.S. industries in the fraction of its revenues devoted to R&D. Overall, U.S. public and private spending on energy technology research, development and demonstration projects comes to no more than \$5 to \$6 billion per year, significantly less than 1 percent of national expenditures for electricity and fuels. Less than \$3.8 billion of that goes to federal and large-corporation R&D, despite the energy industry's annual \$1.3 trillion gross output.<sup>31</sup>

Just as important as the dollar amount is the way the federal energy research laboratories spend their R&D dollars. Without question, the nation needs reliable, affordable and sustainable energy.<sup>32</sup> But today's federal energy research efforts are conducted by stovepipe organizations that focus on incremental or discrete technologies. They do not tackle the more challenging systems problems, which would require integrating R&D on the supply, distribution and end-use needs for different energy sources.

Insufficient research allows energy policies that, all too frequently, are risk-averse and parochial, tending to seriously misjudge the potential for new high-risk, high-payoff, technologically-enabled opportunities. Moreover, few DOE labs are staffed to conduct the market analysis and public policy research required for large-scale deployment of renewable energy sources, for significant gains in energy efficiency or for reduction in fossil fuel consumption.

Our national energy policies must be transformed in order to deliver the technological breakthroughs needed to respond adequately to the nation's energy supply, infrastructure security and sustainability challenges. We also must rethink the institutions that now allocate resources for the energy infrastructure. Current institutions' haphazard delivery of funding subordinates economic need to political gain.

To encourage productive energy-related investments, the country must create more robust and accountable processes:

**In the short term,** the United States should create a network of Energy Discovery Innovation Institutes, based at universities, federal labs and satellite energy research centers. The institutes would serve as the hubs of a distributed energy research network linking the nation's best scientists, engineers and facilities. Research and development is a cost-effective way to move the nation toward greater energy security and efficiency.



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The transport networks in the United States are clogged and congested and the nation's infrastructure as a whole is third-class.

The federal government also should create a National Infrastructure Bank that would select and finance large, multi-modal and multi-jurisdictional infrastructure projects on a merit basis. At its heart, the infrastructure bank idea is about better decision-making. The bank would lend or grant money to individual projects after reasonable benefit/cost analysis. To be eligible, projects would have to be of national or regional significance, a standard that could incorporate the priority of lowering carbon emissions. The bank would consider different types of infrastructure projects, including electrical grid and broadband. This would be a giant step from current federal infrastructure funding, most of which is disbursed as transportation grants to states.

**Over the long term,** an even greater commitment to R&D is needed for clean energy technology. A Green Bank could underwrite needed investments in energy efficiency, environmental protection and future green jobs. Using loans and loan guarantees, this bank would seek to help the United

States and other countries make the transition to a low-carbon economy. It would do so by financing smart energy grid technologies, renewable energy and carbon abatement programs.<sup>33</sup>

Private-sector companies should seek out opportunities to make targeted investments in clean energy and infrastructure. A recent McKinsey survey of executives and investors found that more than 75 percent of environmental, social and governance initiatives were profitable over the long term.<sup>34</sup>



## Emphasize Effective Government

**Governments must learn to innovate, integrate and focus on outcomes.**

The U.S. government has failed to deliver the reforms necessary to meet the challenges of the new global economy, such as deficit reduction,

In order to restore public trust, government must become faster, smarter, more efficient and more integrated.



VACCLAY

unemployment, health care, financial reform, climate change and immigration. Not surprisingly, less than a quarter of the American public is satisfied with the condition of the federal government.<sup>35</sup> Even fewer approve of the performance of Congress. Trust in government remains near historic lows, despite a brief uptick after the election of President Barack Obama. Public regard for local and state government also has declined as a result of crippling fiscal problems. The result is a pervasive discontent with all public institutions. To restore public trust, government must become faster, smarter, more efficient and more integrated.

**Innovation:** Critics argue that it is difficult to introduce accountability, responsiveness and productivity into the public sector because: agencies are large, difficult-to-change bureaucratic organizations; they have few incentives to become more accountable, responsive or productive, and many have monopoly power in their particular area and lack the competition that would require them to improve efficiency and effectiveness.

Nevertheless, many large private organizations have dramatically improved productivity and efficiency despite cumbersome bureaucratic operations.<sup>36</sup> Through a combination of new technology and new organizational structures, they have fundamentally altered the way they do business in order to become more flexible and lean in a period of rapid technological and economic change.

The next economy will require governments to change the way they operate, too. Simply injecting money into the economy—through tax cuts or fiscal stimulus—will not be enough to restore national competitiveness. A good example is the way government handles vital information technology. The U.S. government spends nearly \$80 billion each year on information technology (IT), \$20 billion of which is for hardware, software and file servers. Advances in cloud computing have made it possible to access software, services and data storage through remote file servers and government agencies could achieve between 25 and 50 percent savings by “moving to the cloud.”<sup>37</sup> In

2008, only \$227 million of the federal IT budget was devoted to this strategy.<sup>38</sup> Vivek Kundra, the nation's chief information officer under President Obama, has recognized this opportunity and adopted a "cloud first" policy to accelerate adoption of cloud technology across the federal government.<sup>39</sup> Depending on the eventual scope of the transition, this translates into billions in savings. Los Angeles found a cost savings of 23.6 percent when it put its email system on a cloud platform. The migration allowed the city to reduce technology staff, save money on file servers and economize in software purchases. The city of Washington, D.C. witnessed savings of 48 percent from its shift to cloud computing.

Technology offers increasing opportunities for citizens to participate in the governance of their communities and the nation. Social networking applications and other innovations in communications technology have dramatically lowered the costs of sharing information with residents and, in turn, given them new avenues to provide government direct feedback on its performance. The House of Representatives recently authorized use of tablet computers and smartphones on the floor for the first time.

Governments at all levels have made tremendous progress in providing access to online services. In 2000, only 22 percent offered online services. Today, that number has grown to nearly 90 percent. Nearly two-thirds of Americans pay their income taxes online. Forty percent have gone online for government data.<sup>40</sup> One-third have renewed a driver's license or auto registration online. Twenty-three percent have participated in online debates about government policy. Thirteen percent have read a government blog.

Many agencies have added novel features to their websites. For example, the Wyoming Supreme Court has a database of its opinions online. West Virginia provides a "live chat with customer support" for its website visitors. The Indiana portal helps visually impaired visitors by reading web pages aloud in English. The state of Michigan portal provides ten

podcasts, 72 RSS feeds, information in languages such as Spanish and Arabic and online forms in Albanian, Chinese, French, Hmong, Korean, Polish, Russian, Serbo-Croatian and Vietnamese. On the Wisconsin portal, a business wizard helps users locate information about starting a business. These and other features have enhanced residents' access to information and services.

At the federal level, the Obama administration has placed unparalleled amounts of federal data online at Data.gov. Each department has chosen data sets for inclusion that help individuals and businesses. There is information on airport flight delay times, car safety ratings, crime statistics, small business loans and business permits, and more. You can download the raw data, map the information or search for particular items of interest. Online information lowers the cost of information acquisition and makes it easier for citizens and businesses to order and use services, data and reports.

**Integrate:** The examples above come from all levels of government. An integrated global economy requires government policies that recognize the connection between local businesses, national policies and international markets. Institutions developed to fit the needs of an industrial economy must be remodeled to meet the demands of the information age. The next economy will require a government as nimble as its individual citizens, one that supports the small businesses and innovative entrepreneurs who will create jobs (for others and for themselves) in the new century. National competitiveness will depend on the ability to provide opportunities for innovative citizens to offer their services and goods to consumers scattered across the globe.

To unleash the entrepreneurial energy and dynamism of the economy, we must rethink relationships among federal and state governments and the cities (and citizens) they govern. All of the economic goals outlined above—budget rebalancing, export facilitation, education reform and energy innovation—will require leaders at

The state of Michigan portal provides ten podcasts, 72 RSS feeds, information in languages such as Spanish and Arabic and online forms in Albanian, Chinese, French, Hmong, Korean, Polish, Russian, Serbo-Croatian and Vietnamese.



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Unless we take more decisive action to ensure the reliability and security of our electronic infrastructure, it will be difficult to move forward.

different levels of government to pursue integrated strategies and coordinate their actions.

Local communities bear the brunt of budget austerity. As states and the federal government cut back, local governments search for innovative ways to provide essential services to their constituents. To generate the revenue needed to pay for those services, local government, too, will have to do a better job of fostering economic growth. Each community will have to build industries that make their products more competitive in price, quality or features, so that they can compete in the global economy by exporting to international consumers as well as by attracting new domestic customers.

Successful local governments will have no choice but to create and support innovative institutions to provide infrastructure and skilled employees. States and the federal government must do a better job of investing in the places where most of their citizens live, work, learn and create. The benefits of state and national investments are amplified when they are aligned with the specific advantages of particular metropolitan areas, whether that is a group of interconnected firms in a particular economic sector, strength in

fast-growing service exports, globally powerful research institutions or community colleges that develop customized job training. And government could improve performance at all levels if it incorporated best practices from the private sector into its management and operations.

**In the short term,** all levels of government should adopt digital technology to improve delivery of services and move aggressively to cloud computing in order to achieve service improvements and cost efficiencies. Government also should prioritize the use of social networking and other digital innovations to enable citizen collaboration and participation and to increase the transparency and performance of the public sector.

Congress should enact legislation for the digital world that protects privacy and safeguards innovation in health care, education, energy efficiency and public sector performance. Unless we take more decisive action to ensure the reliability and security of our electronic infrastructure, it will be difficult to move forward.

**Over the long term,** governments at all levels, in collaboration with private sector, civic and philanthropic leaders, should develop business plans for future economic growth. As being piloted in metropolitan Cleveland, Minneapolis-St. Paul and Seattle, in partnership with Brookings, metropolitan business planning is a new “bottom up” model for applying the methods of private-sector business planning to the public sector.<sup>41</sup> These business plans are low cost and high impact. They provide federal policymakers with a framework for engaging effectively in regions and emphasize targeted policy interventions to build on regional strengths. Resources can then be deployed according to the needs of a particular place, rather than the whims of a particular interest. Guided by region-specific business plans, the impact of federal investment can be maximized, while the private and civic sectors can leverage additional resources to close gaps that appear in the plans.

# Conclusion: Implementing a Growth Agenda

Long-term U.S. economic prosperity depends on identifying a different economic and political path forward. This implies not just the adoption of new policies, but a new approach to problem solving. We must rely on investment, infrastructure development, engagement with the private sector and a renewed attention to innovation. There are three crucial steps that need to be undertaken:

- turn our deficits in the budget, trade and investment and savings into surpluses;
- invest in four key drivers of the next economy—innovation, global markets, human capital and the reduction of energy costs; and,
- improve government innovation and performance.

The vision of the economy laid out here is local, state and national in scope. These areas are “co-producers” of the next economy and every action outlined above must coordinate across levels of government. Some of the actions require congressional action, while others involve initiatives at the state or local levels. Others can be implemented outside the legislative process by administrative actions or executive orders.

The new economy must be built the hard way, via a pragmatic caucus of public, business and nonprofit leaders who can spur economic recovery and renewal from the ground up, despite fiscal obstacles and long political odds. The need for intentional, bottom-up strategies is not just dictated by political realities, it is fundamentally consonant with the demands of the next economy.

With the limited resources of public agencies at all levels of government, though, those who are serious about innovation must figure out how to use

public funds to leverage private-sector resources. Government departments do not have the money to finance as much innovation as is needed. In many areas, much of the successful innovation must be funded by private companies. For example, the Federal Communications Commission estimated it would require \$350 billion to build high-speed broadband accessible to nearly all Americans. Yet in the 2009 ARRA, the federal government budgeted only \$7 billion for new broadband infrastructure. This means that, if widely available broadband is to become a reality, 98 percent of its costs must be borne by private corporations (and passed on to consumers). The most critical role of the government in the next economy is building public-private partnerships and encouraging sustainable policies on the part of businesses.

A new, stronger economy is possible with the leadership of a pragmatic caucus of citizens. The Brookings Institution considers this challenge—of restoring growth through innovation—to be an institutional priority and our scholars will continue to provide quality research and analysis for citizens on these issues. We also hope to provide a space for citizens and public officials—whatever their politics—to convene and discuss the problems our nation faces and the way forward. This paper provides a way to begin this needed dialogue and we look forward to continuing this conversation in public and private forums over the next year. ■

Long-term U.S. economic prosperity depends on identifying a different economic and political path forward. This implies not just the adoption of new policies, but a new approach to problem solving.

## Endnotes

1. West, D.M. 2011. *The Next Wave: Using Digital Technology to Further Social and Political Innovation*. Washington, D.C.: Brookings Institution Press.
2. Berube, A. 2007. *Metro Nation: How U.S. Metropolitan Areas Fuel American Prosperity*. Washington, D.C.: Brookings Institution, 2007.
3. Toder, E.J., Harris, B.H., & Lim, K. 2009. *Distributional Effects of Tax Expenditures*. Washington, D.C.: Urban-Brookings Tax Policy Center.
4. Gyourko, J. & Sinai, T. 2001. *The Spatial Distribution of Housing-Related Tax Benefits in the United States*. Washington, D.C.: Brookings Institution.
5. Atkinson, R. & Wial, H. 2008. *Boosting Productivity, Innovation, and Growth through a National Innovation Foundation*. Washington, D.C.: Brookings Institution.
6. See, for example, Solow, R., (1956) A Contribution to the Theory of Economic Growth, *Quarterly Journal of Economics*, 70, 65–94; Swan, T.W., (1956) Economic Growth and Capital Accumulation, *Economic Record*, 32, 334–361; Abramovitz, M., (1956) Resources and Output Trends in the United States since 1870, *The American Economic Review*, 46, 5–23; Solow, R., (1957) Technical Change and the Aggregate Production Function, *The Review of Economics and Statistics* 39, 312–320.
7. Atkinson, R. & Wial, H. 2008, *op. cit.* Economist Charles Jones finds that R&D accounts for around 1.4 percentage points of annual GDP growth. Some economists estimate that R&D's rate of return to the United States as a whole (not just the return to the firms that undertake it) is as high as 30 percent.
8. *Ibid.*, note 29.
9. Barton, D. March 2011. Capitalism for the Long Term. *Harvard Business Review*, pp. 8 *et seq.*
10. West, D.M. 2011 (forthcoming). *Improving University Technology Transfer and Commercialization*. Washington, D.C.: Brookings Institution.
11. Frankel, J. & Romer, D. 1999. Does trade cause growth? *American Economic Review*, 89, 379–399; Wacziarg, R., & Welch, K.H. 2008. Trade Liberalization and Growth: New Evidence. *The World Bank Economic Review*, 22, 187–231; Kuznets, S. 1966. *Modern Economic Growth*. New Haven, Conn.: Yale University.
12. To elaborate on the point, Adam Smith argues that a nail-maker in a village in Scotland would have the capacity to make 300,000 nails in a year, if this was his primary activity. But there is no market for that many nails in his village, so he can only sell 1,000 nails in a year and must split his time in other fields of smithery. He has no incentive to increase the productivity of his nail-making business, because he can't trade with enough people. Smith, A. (1904/1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*. London, U.K.: Methuen & Co., Ltd.
13. Aw, B-Y, Roberts, M.J., & Winston, T. 2007. Export Market Participation, Investments in R&D and Worker Training, and the Evolution of Firm Productivity. *World Economy*, 30, 83–104.
14. Rosen, H. 2009, December 9. "The Export Imperative," testimony prepared for the Senate Finance Committee—Subcommittee on International Trade.
15. China assembles iPods, iPhones, iPads and laptops, but retains only a few dollars of the total value, with the rest going to other Asian suppliers of components as well as Apple, Microsoft and Intel. China is exporting assembly more than it is exporting high technology. Edwards and Lawrence (2010) find that China's exports to the United States remain concentrated in low-value products. Edwards, L., and Lawrence, R.Z. 2010. *Rising Tide: Is Growth in Emerging Economies Good for the United States?* Washington, D.C.: Peterson Institute for International Economics.
16. Istrate, E., Rothwell, J., & Katz, B. 2010. *Export Nation: How U.S. Metros Lead National Export Growth and Boost Competitiveness*. Washington, D.C.: Brookings Institution.
17. Baily, M.N. & Farrell, D. 2006. Breaking Down Barriers to Growth. *Finance & Development*, 43. Accessed May 16, 2011, from <http://www.imf.org/external/pubs/ft/fandd/2006/03/baily.htm>.
18. Mills, K.G., Reynolds, E.B., & Reamer, A. 2008. *Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies*. Washington, D.C.: Brookings Institution.
19. Aw, B-Y. 2002. Accumulating Technology and Location Spillovers Among Firms in Taiwan's Electronics Industry. *The Journal of Development Studies*, 39, 94–117.
20. Katz, B., Bradley, J., & Liu, A. 2010. *Delivering the Next Economy: The States Step Up*. Washington, D.C.: Brookings Institution.
21. West, D.M. 2010. *Brain Gain: Rethinking U.S. Immigration Policy*. Washington, D.C.: Brookings Institution Press; West, D.M. 2010 (July 16). Restoring American Competitiveness Through Immigration. *Wall Street Journal*.
22. Mishel, L., Bernstein, J., & Allegretto, S. 2007. *The State of Working America 2006/2007*. Ithaca, N.Y.: ILR Press.
23. Goldrick-Rab, S., Harris, D.N., Mazzeo, C., & Kienzl, G. 2009. Transforming America's Community Colleges: A Federal Policy Proposal to Expand Opportunity and Promote Economic Prosperity. Washington, D.C.: Brookings Institution.
24. U.S., Department of Education, National Center for Education Statistics. 2007. *Digest of Education Statistics*. Table 184 (based on 2005 data). Washington, D.C.: Author.
25. *Ibid.*, Table 338.
26. Katz, B., Bradley, J., & Liu, A. 2010, *op. cit.*
27. This section draws heavily on Duderstadt, J., Muro, M., & Rahman, S. 2010. *Hubs of Transformation: Leveraging the Great Lakes Research Complex for Energy Innovation*. Washington, D.C.: Brookings Institution.

28. These include state renewable portfolio standards, described in Rabe, B. 2006. *Race to the Top: The Expanding Role of U.S. State Renewable Portfolio Standards*. Washington, D.C.: Pew Center on Global Climate Change, available at <http://www.pewclimate.org/publications/report/race-top-expanding-role-us-state-renewable-portfolio-standards> as well as national carbon reduction strategy, such as that of the UK Department of Energy and Climate Change, *UK Low Carbon Transition Plan* (2009), available at [http://www.decc.gov.uk/en/content/cms/what\\_we\\_do/lc\\_uk/lc\\_trans\\_plan/lc\\_trans\\_plan.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/lc_trans_plan/lc_trans_plan.aspx). Generally, see Gurria, A., & Leape, J.P. (undated). Climate change: the biggest threat to economic recovery. *OECD Observer*, available at [http://www.oecdobserver.org/news/fullstory.php/aid/3074/Climate\\_change:\\_the\\_biggest\\_threat\\_to\\_economic\\_recovery.html](http://www.oecdobserver.org/news/fullstory.php/aid/3074/Climate_change:_the_biggest_threat_to_economic_recovery.html)
29. One indication of the reach of this change can be found in the definition of the new energy economy in the *Platform for Retaining and Creating Midwestern Jobs in the New Energy Economy* prepared by the Midwestern Governor's Association. The definition states, "A new energy economy generates jobs, businesses and investments while expanding energy production; increasing energy efficiency; reducing carbon emissions, waste and pollution; and conserving natural resources." The Platform is available at <http://www.midwesterngovernors.org/Publications/JobsPlatform.pdf>. See also an undated paper by Rifkin, J. *Leading the Way to the Third Industrial Revolution*, available at <http://www.foet.org/packet/Global.pdf>, and a July 2009 report from the UK Department of Transport, *Low Carbon Transport: A Greener Future*, available at <http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/pgr/sustainable/carbonreduction/>.
30. Duderstadt, J., Was, G., McGrath, R., Muro, M., Corradini, M., Katehi, L., Shangraw, R., & Sarzynski, A. 2009. *Energy Discovery-Innovation Institutes: A Step toward America's Energy Sustainability*. Washington, D.C.: Brookings Institution.
31. Duderstadt, J., Was, G., McGrath, R., Muro, M., Corradini, M., Katehi, L., Shangraw, R., & Sarzynski, A. 2009. *Energy Discovery-Innovation Institutes: A Step toward America's Energy Sustainability*. Washington, D.C.: Brookings Institution.
32. Sovacool, B.K. 2008. Replacing Tedium with Transformation: Why the US Department of Energy Needs to Change the Way It Conducts Long-Term R&D. *Energy Policy*, 36, 923–928.
33. West, D., Kimball, R., Nathoo, R., Zwirn, D., Ramachandran, V., Goldstein, G., & Moser, J. 2011. *Rebuilding America: The Role of Foreign Capital and Global Public Investors*. Washington, D.C.: Brookings Institution.
34. Barton, D. 2011 (March), *op. cit.*
35. CNN. 2010 (February 21). Survey: Most Americans believe government broken, available at [http://articles.cnn.com/2010-02-21/politics/poll.broken.govt\\_1\\_opinion-research-corp-broken-cnn?s=PM:POLITICS](http://articles.cnn.com/2010-02-21/politics/poll.broken.govt_1_opinion-research-corp-broken-cnn?s=PM:POLITICS).
36. West, D.M. 2011, *op. cit.*
37. West, D. 2010. *Saving Money through Cloud Computing*. Washington, D.C.: Brookings Institution.
38. Wyld, D. 2009. *Moving to the Cloud: An Introduction to Cloud Computing in Government*. E-Government Series. Washington, D.C.: IBM Center for the Business of Government.
39. Kundra, V. 2010. *25 Point Implementation Plan to Reform Federal Information Technology Management*. Washington, D.C.: The White House.
40. Smith, A. *Government Online*. A report of the Pew Internet & American Life Project, April 27, 2010. Accessed April 27, 2011, from <http://www.pewinternet.org/Reports/2010/Government-Online.aspx>.
41. Weissbourd, R., & Muro, M. 2011. *Metropolitan Business Plans: A New Approach to Economic Growth*. Washington, D.C.: Brookings Institution.

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