

2 Challenges Facing Science and Technology after September 11

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It is hard for us to fully comprehend how much our world changed on September 11. The challenges that we now face may not be that different from the challenges we faced a year ago, but our awareness of these challenges has changed dramatically. As a result everything we deal with is different.

This chapter discusses the new pressures on the federal budget, especially for science, and the challenges presented by the changing demographics. I also discuss how efforts to advance science must change and specifically how strategies to increase the resources available for scientific inquiry must change if we are to maintain momentum.

New Pressures on the Federal Budget since September 11

The federal government today faces a decline in resources at the exact moment that it also faces a dramatic increase in the demands for those resources. That puts us all in a difficult position.

The U.S. economy slowed last year, reducing receipts to the federal treasury. Recovery is tepid and long-term. This situation will affect revenues not only in FY 2001 and FY 2002 but probably in FY 2003 as well. Growth from a lower base produces less revenue.

The impact that the economy has had on revenues was seriously compounded by changes in the federal tax law that were adopted last summer. The new tax law does not by itself explain the dramatic reversal from fiscal surplus to triple-digit deficits in one year, but it was a major contributor and

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it will erode the federal tax base by larger and larger amounts over the next 10 years. This tax bill will cost the government nearly \$100 billion in the coming fiscal year. Revenues lost to that bill will exceed a quarter of a trillion dollars a year by the end of the decade.

But the decline in available revenues is no more dramatic than the increased and urgent demands for government action brought about by the attacks of September 11. At the very time our capacity to finance existing government responsibilities was being eroded, a number of new and very expensive challenges were thrust upon us.

We have had significant increases in defense spending. We are now considering the third supplemental budget for defense in less than nine months. What is not well known is that the Administration has not told us the full costs of September 11 with respect to spending on defense, homeland security, and foreign assistance.

The \$14 billion that the President recently requested for the Department of Defense (DOD) will not cover operations through the remainder of this fiscal year. Payments for National Guard and Reserve call-ups that have already taken place are understated by nearly \$2 billion. When the seemingly enormous increase of \$45 billion (13 percent) in Pentagon spending that the President has requested for next year is compared to what we will really spend in the current year the actual increase is much smaller. In addition, because hard decisions to phase out lower priority or unneeded weapon systems have been delayed, it is quite likely that the Pentagon will need another increase before the end of FY 2003. And this assumes nothing with respect to action against Iraq or other potential conflicts that the White House is now considering.

But the increase in defense spending is only one budgetary impact of September 11. It is probably easier to produce a list of government responsibilities that were not affected by September 11 than those that were. And these responsibilities must be met with increased cost. For example, we have ordered huge changes to protect airlines from terrorist attacks. But most of the bills for those changes have not been paid. We have hired more customs inspectors and more Federal Bureau of Investigation special agents. We have also begun hardening federal buildings against bombs, germs, and chemicals. But we are not yet at levels that most analysts feel we will require. We are only in the beginning phases.

Infrastructure Needs

We live in an asymmetrical world. Our enormous military might has left those who object to our policies, values, or culture with few options for defiance. Osama bin Laden, (whether he is living or dead) has provided such persons with a strategy for leveling the playing field. Defending ourselves against these terrorist strategies will require a retooling of virtually every aspect of our physical and economic infrastructure.

We will need massive changes in our information systems. For example, the approval of a visa by our State Department consular services should be immediately available to law enforcement agencies, including the Immigration and Naturalization Service and the U.S. Customs Service. We will also need radical changes in the way our whole international shipping and port systems work. We will require much more sensitive means of detecting radiological, biological, and chemical hazards. And we need to destroy enormous quantities of nuclear and biological weapons or find much better ways to protect them.

Dealing with Strategic Voids

There are still other expensive implications to September 11. Before the fall of the Berlin Wall almost every square inch of land on this globe was contested by the superpowers. But after the fall of the Soviet Empire, a large portion of the globe became of no “apparent” strategic concern to anyone. Some foreign policy analysts called these areas “strategic voids.” In many instances these areas have no effective government or central authority. They are breeding grounds for terrorists, drug traffickers, kidnappers, and a host of other criminals. Afghanistan is only one country on a long list of such places. Yemen, Somalia, Rwanda, portions of the Philippines, Burma, the Balkans, and significant areas of Latin America (including an area of Colombia larger than the state of Texas) are all strategic voids.

Developed countries cannot protect themselves from terrorism and other organized criminal attacks unless they establish legitimate law-abiding governments in these strategic voids. That will require the very frustrating and expensive process of nation building. The recent dramatic increase in foreign aid promised by the President is far less than what will be required in

any intelligent attempt to protect Americans from the lawless gangs that invariably thrive in areas that lack legitimate government.

Science in the Budget

What is happening with science this year? If you simply skimmed the President's budget you might think science was continuing to do relatively well. You would see a lot of flowery comments about the importance of research and development (R&D) to our economy and security. You might also think the numbers themselves seem satisfactory. The budget proposes to invest \$111.8 billion for R&D, which is an increase of \$8.6 billion (eight percent) above last year. That more than doubles the amount needed to keep up with inflation.

But it takes very little examination to realize that these increases are highly concentrated on a few areas of the whole range of federal research activities. Of the \$3.9-billion increase slated for civilian research, 100 percent goes to a single agency—the National Institutes of Health (NIH).

That is not a good idea from the standpoint of biomedical research. To double NIH's budget by FY 2003 and then provide no promise of increase beyond that date is to add hundreds of investigators to the federal grantee rolls who would not have competed successfully had NIH grown at a normal pace. These will be three-year grants and will have to be accommodated in the NIH budget in FY 2003 and FY 2004, with or without additional increases. As a result, NIH will be able to fund very few new and renewal grants in those years without additional increases. This means that we are likely to fund lower priority proposals in the coming year at the expense of higher priority proposals in subsequent years. As a result some of the most competitive and valued investigators stand to be forced out of the system.

It should also be noted that the strong justification for expanding biomedical research is the great potential generated by the Human Genome Project. This work requires a very broad array of scientific disciplines including those that are far more math-intensive than the ones presently involved in biomedical research. If biology is in fact more complex than the other scientific disciplines, we should cast a broader net and involve a greater portion of the scientific community.

I am all for the increase in NIH funding, but it should not be to meet an arbitrary political goal and then provide for no further expansion. And it should not come at the expense of all other research. But this budget cuts all the rest of civilian research outside NIH below last year's nominal spending levels. If you add the proposed budgets of the National Science Foundation, the National Aeronautics and Space Administration, the Department of Energy, the National Oceanic and Atmospheric Administration, and the other research components of the federal government you have a sum that shows we are spending \$30 billion less in the coming year than we are spending now. Since research costs are rising faster than other costs you have a net loss of research in those agencies of well over three percent. With the exception of NIH we are not even standing still—we are moving backward.

Despite outward appearances on the DOD side, things are really not a lot brighter. The budget proposes moving defense R&D up from \$49 to \$54 billion for the coming year. That looks like an eight percent increase. But again, the devil is in the details. The Administration's inability to make choices has resulted in bringing three new fighter programs into production simultaneously: the E&F (educator and facilitator) series of the F-18 Hornet, the F-22 Raptor, and the Joint Strike Fighter. Not only will the procurement costs of these planes be prohibitive but the development costs are also steep. Nearly half of the entire R&D growth at the Pentagon is attributable to the growth in the development costs of the Joint Strike Fighter.

This concentration on increasing our air superiority is not the best choice we can make. The global war on terrorism will place a wide range of new demands on the U.S. military. Never before has the problem of finding the enemy been greater. Never before have we faced such difficult requirements in terms of time and distance. But if there is a single area in which we are not being challenged it is in our air superiority. I cannot think of a single scenario that would permit any terrorist organization or state to produce aircraft that are competitive with current U.S. and allied fighters. Yet we are spending much of our R&D investment on developing and building a new fighter.

Most of the Pentagon R&D increase that is not going to the Joint Strike Fighter is going to missile defense. As a result, general DOD research,

both applied and basic, is essentially flat. When inflation is factored in, we will be buying less research in the coming year than we are performing today.

But I think it would be a mistake to judge this budget based solely on funding proposals for one year. The real problems are in the future. Estimates from the Congressional Budget Office indicate that the President's budget will result in overall funding for nondefense discretionary programs to decline from \$370 billion in the current year to \$360 billion in the coming year and \$357 billion within three years. Declines in inflation-adjusted spending will continue through the rest of the decade.

The problem is that simply keeping pace with inflation is not adequate in a dynamic and growing society. The U.S. Census Bureau estimates that our population will increase from 280 million to more than 304 million in the next 10 years—an increase of 24 million or the equivalent of annexing four-fifths of Canada. Nominal gross domestic product is expected to grow from \$10 billion to more than \$17 billion, an increase equivalent to the combined economies of England, France, Germany, and Spain. This means huge new demands on infrastructure, education systems, health care, and energy supplies.

If we live within the discretionary totals permitted in the President's budget it also means a huge scramble for resources in Washington—one that will be far more intense than the one we see now. Within these totals we will have to accommodate all new demands for homeland security and increased foreign assistance. Even so, I predict that some advocates like the veterans and the highway lobby will hold their own or at least come close. That means that others will be squeezed terribly.

If this analysis sounds sensible and you care about the advancement of science, then you need to put together a plan to cope with these realities. One strategy is to outmatch the other lobbies in Washington for the scarce resources that are left on the table. A second strategy is to join with others who are facing this squeeze and try to reverse the budget and tax policies that created the squeeze. A third strategy is to look to the private sector for resources. The second choice seems most reasonable. I think people who care about science owe it to the country to try to reverse these policies.

We face another second challenge that is every bit as daunting as the war on terrorism. It is essentially a challenge of demography. Science will play a central role in its solution.

The Challenge of Changing Demographics

As the baby boomers begin retiring at the end of this decade we will have fewer and fewer workers to pay the bills and more and more elderly with medical and subsistence needs. A popular view in Washington is that we should save for that eventuality. If we build up large surpluses in the Social Security and Medicare Trust Funds then we will have the money when it is needed. That analysis seems to make sense on the surface. But societies are not like individuals. Societies must balance their books on a year-to-year basis. Stated more simply, you can borrow from your neighbor as long as he is not also attempting to borrow from someone. You can lend to your neighbor as long as he is not attempting to also be a lender.

Societies that plan to be large lenders for a period of time and then large borrowers at some future point inevitably run up the value of their assets (real estate, stocks, bonds, etc.). The value of those assets collapses when the time comes for the society to collectively draw on them. When large numbers of individuals save for their retirement and the government adds to that savings and then begins to make withdrawals at the same time as the individuals, you have a fiscal policy that is simply increasing the size of the bubble.

That is precisely what happened in Japan. One could argue that the huge increase in equities and real estate values in the United States in recent years is an indication of the same problem. The question is: How can we all cash in our retirement accounts at the same time? Who will buy?

Federal Reserve Board chairman Alan Greenspan suggested an answer to that problem a little more than two years ago when he stated, "something extraordinary has happened to the U.S. economy in recent years." That extraordinary thing was the growth in productivity. The chairman attributed that to new technologies such as supercomputers, gene splicing, robotics, and the Internet. What is stunning to most ardent free enterprisers is that a huge percentage of these advances for which they so proudly accept credit are largely the result of public investments. Investments made by the National Science Foundation and the U.S. Air Force in the 1950s created the backbone of what has become the Internet. The sustained outlays at NIH created the biotechnology industry. We as a society spent money on

these things 30, 40, even 50 years ago. Only in the past decade and a half have they begun transforming our economy and our society.

But the growth generated by these scientific advances does not continue indefinitely. New scientific breakthroughs will be required if we are to sustain the growth rates we enjoyed in the 1990s into the next decades. At that time, we will have a declining work force and a work force that is increasingly made up of people from lower income households with less opportunity for educational attainment.

Conclusion

The scientific community should not attempt to simply get a larger slice of a shrinking pie, even if it could muster the clout to overcome other interests to do so. Fancy new machines will do little to spur the economy and sustain growth without the workers capable of using them. Training these workers will be a huge task since America's school-age population is coming increasingly from disadvantaged and immigrant households.

The investments needed are not huge in terms of the overall size of the U.S. economy. They will not impinge on the ability of the private sector to grow and flourish. To the contrary, they will provide American business with the technological and human resources that business by itself cannot generate. It is a bold path and one that we might be reluctant to venture down. But it is the only course that will reverse the unfortunate trend we are now facing.