

Innovation for Innovators

an occasional column exploring principles, models, and theories of innovation in business and management

Roger Smith

R&D in the Financial Crisis

R&D at NASA, NSF, NIH, and DOE has fared very well in the new administration's stimulus plan. But what role does R&D really play during a financial crisis? Where does it fall on the list of economic priorities for the country when there is a long list of organizations that need financial support?

R&D funding certainly creates jobs for scientists in the same way that infrastructure funding creates jobs for construction workers or defense funding creates jobs for engineers and manufacturing workers. But which is more immediately stimulative - a dollar spent in a research lab or a dollar spent on the highway? Both investments provide jobs today and finished products tomorrow. Research funding might lead to a new synthetic material or energy source in 10 years. A new highway or bridge might lower transportation costs and increase economic activity between regions that lie along its path.

The effects of R&D spending on the national economy were the topic of a 2007 study by the U.S. Bureau of Economic Activity and the NSF. This study showed a direct growth in GDP for industrial sectors that rely heavily on R&D. [1] Until recently, economists have measured R&D in the same way that they have measured infrastructure, the cost to create a physical facility. [2] But economists are trying to change this. They have realized that the historic link between innovation, R&D, and new jobs seems to have stopped. [2] In the 2009 edition of the annual NSF R&D survey, 40,000 businesses have been asked to describe how they use internal and government funds for R&D, where it is spent and how much is directed toward services versus manufactured products. [3]

There is a need for an economic model that describes the national stimulative effect of money spent on R&D. Certainly the proponents for R&D and infrastructure can both provide case studies of investments that bore no fruit, while both can also show cases where small amounts of money led to huge economic returns. But is there any dependable pattern to the effect of spending in these areas?

Lawrence Summers, the new Director of the National Economic Council, has said that, "[a] question that should be much more of a preoccupation for all of us is – what are the animating technologies that are going to drive our economy forward? There was a tremendous wave of innovation in connection with the Second World War: the jet airplane, electric technologies, and more. Their diffusion fueled a period of rapid productivity growth, which improved standards of living and made almost everything else work well for the generation after the war." [4]

Summers is focusing on the ROI for investments in new technology. R&D prior to, during, and after WWII provided huge advances in radar, microwave, radio, television, nuclear power, and transportation. The research generation that followed brought us personal computers, cellular communication, the Internet, web-based businesses, and logistic and operational efficiencies. But the WWII era investments were not completely unique in time and effect. That initial momentum of invention and innovation has carried through to this day. The 1940's were a significant launching point that changed forever the nation's and the world's views of what science and technology can add to human existence.

Our own publication has included many articles on the positive, negative, and null effect that R&D investment has on the financial future of individual companies within an industry. But we do not appear to have looked at the impact that R&D has on the national economy and compared it to the impact of other activities and investments. This kind of insight and a model of it are essential tools in engaging national leaders to apply public money to R&D or creating R&D incentives for corporations.

The economic crisis and the election of a new president have led a number of writers to offer prescriptions for R&D.

David Goldston has suggested that, "The Obama administration's promised economic stimulus package offers another opportunity to align policy goals with research priorities. Truly inventive transportation research has never received more than crumbs. We need more R&D on information networks and intelligent highways that direct drivers to the fastest routes, better-planned communities that reduce the need to drive in the first place, and more flexible and appealing mass transit systems." [5]

His focus on transportation suggests improvements in efficiency and quality of life. Investments in infrastructure, which may include new technology, can reduce the amount of wasted time and energy that the nation spends commuting between home and work. These changes could improve individual and organizational productivity, getting more work out of the same resources. This kind of productivity was one of the major interests of former Federal Reserve Chairman, Alan Greenspan. He could see the impact that computer technologies were having by allowing each person to generate more value and revenue for a company and for the country. Turning "drive time" into "work time" could have a similar effect, though the scales may be different. Greenspan believed that computerization was improving productivity by 3% per year, effectively adding 1.2 hours of productive labor to each employee every week for a year. [6] Reducing drive time may be able to generate this kind of improvement as well, but without a compounding effect. It might eliminate one hour of daily travel from those in the new highway and community system, providing a 12.5% fixed productivity opportunity for the fraction of the population that are significant commuters with access to the new system. This 12.5% boost is a one-time, but constant level of improved productivity. Its effect on the national economy is diluted by the ratio of commuters who can use it to those who do not commute or cannot access the system. There may be some logic in assuming that people

who have such a significant commute hold jobs with high pay and high contributions that motivate people to accept the commute in the first place. So this improvement may accrue to exactly the people who can make the biggest contribution by adding an hour to their day.

David Duncan observed that President Obama was very supportive of R&D funding and eager to find areas in which research can make a big difference in society. “During the campaign, Obama talked about launching an initiative to create renewable sources of energy akin to the Apollo space program in the 1960s that put men on the moon. Among other things, he said he wants to double the budgets of the National Institutes of Health, the National Cancer Institute, and other federal research and development agencies in the next 10 years.”[7]

Improvements in medicine are another form of productivity enhancer. In a society with a larger portion of senior members, medical advances that allow them to live a more healthy, active, and productive life accrue to the benefit of all of society. Instead of suffering the infirmities of age, a big portion of society may remain healthy enough to avoid heavy use of government supported medical programs. Some of them can choose to continue working and making an economic contribution at an age when their parents were unable to make that choice. These kinds of economic contributions are not of the accumulative type described by Greenspan, but are more like an annuity that makes payouts every year, and is reducing in value rather than growing through compounding.

Finally, Julian Sidel has reflected on the new administration’s intention to create a Federal CTO position. “I think that’s very important in an era when most of the nation’s major policy challenges revolve around science and technology. The president can’t make fully informed policy decisions without taking the science into consideration, so having that voice in cabinet discussions is very important.”[8]

In the face of financial crisis this seems to be an administration that understands the importance of science and technology in society and the historical impact that successful R&D has had on society. But, in the absence of an economic model that can compare the beneficial effects of a dollar of research versus a dollar of infrastructure, the question of which is better for the country falls away unanswered.

From 1975 to 1980 IRI operated its own Research Corporation in conjunction with member companies, the NSF, DOE, and DOC. Cooperatively the group studied the effects of corporate R&D and specific types of technology. After 20 studies and two million dollars, activities of the corporation were suspended. This demonstrates a precedent of working with government agencies which could be reemployed around areas of the national economy.

References

1. Okubo, S. et al. (2006). Bureau of Economic Analysis/National Science Foundation R&D Satellite Account: Preliminary Estimates. Online at: <http://www.bea.gov/newsreleases/general/rd/2006/pdf/rdreport06.pdf>

2. Mandel, M. (Sept 11, 2008). Can America invent its way back? *Business Week Magazine*. Online at http://www.businessweek.com/magazine/content/08_38/b4100052741280.htm
3. National Science Foundation. (2009). Business R&D and innovation survey. Online at <http://www.nsf.gov/statistics/srvyindustry/about/brdis/>
4. McCormack, R. (Dec 3, 2008). Research and development will not be included in President-elect Obama's massive economic stimulus package. *Manufacturing and Technology News*, 15(21). Online at <http://www.manufacturingnews.com/news/08/1203/summers.html>
5. Goldston, D. (no date). Science we can believe in: How President Obama can recharge US research. *Wired Magazine*, 17(1). Online at http://www.wired.com/culture/culturereviews/magazine/17-01/st_essay
6. Greenspan, A. (2007). *The Age of turbulence: Adventures in a new world*. Penguin Publishing.
7. Duncan, D. (Nov 5, 2008). Natural Selection. *Portfolio Magazine*. Online at <http://www.portfolio.com/>
8. Siddle, J. (Jan 20, 2009). Scientists optimistic over Obama. *BBC News*. Online at <http://news.bbc.co.uk/1/hi/sci/tech/7792171.stm>

Roger Smith is the chief scientist and chief technology officer for U.S. Army Simulation, Training, and Instrumentation, in Orlando, Florida. He has also served as a group-level CTO for Titan Corporation and as a vice president of technology for BTG Inc. A member of RTM's Board of Editors, Smith has led technology innovation for software and computer systems for military training and command systems. He holds a Ph.D. in computer science and Doctorate in business administration.