U.S. Science and Technology Trends and Priorities for U.S.-Foreign Cooperation
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Thank you for inviting me to speak today. When I was President of the State University of New York at Stony Brook in the 1980's we had vigorous exchange programs with several Polish universities, and I came to appreciate the excellent quality of science there. Now it appears that the potential for technologically based economic development is beginning to be realized, and I am happy to be in a position to help, even if only by articulating U.S. priorities for science and technology.

In his letter of invitation, George Handy (Director of CSIS's International Action Commissions Programs) asked me to address (1) U.S. national priorities for science and technology and the associated expectations for the U.S. private sector, foreign governments, and the foreign private sector, and (2) elements of the innovation process in the U.S. that have led to our success in high tech developments, and (3) the roles of public and private capital in innovation in the U.S. These are all big topics, and I will not be able to address them adequately in the time available this morning. But I will say something about each, and rely on others in this conference to add more detail.

National science and technology priorities

If priorities are expressed by budgets, then the quickest way to understand U.S. research and development priorities is through the pattern of allocations to the agencies that support science and technology. As you are probably aware, the U.S. does not fund science and technology through a single agency. Our National Science Foundation (NSF) expends only a small fraction of the total R&D investment of approximately $130 billion. About half of this amount is allocated to the Department of Defense, of which nearly all is for the "D" in R&D, namely the development of advanced weapons and military support systems. The remaining half is shared among five primary science agencies and numerous other agencies in which science is a small, but sometimes important, part of the agency mission.

Of the roughly $60 billion in non-defense development funding, nearly half (47%) goes to the National Institutes of Health (NIH) for bio-medical research. Most of the remainder is divided among NASA (16%), NSF (10%), DOE (9%), DOD (9%). These "big five" account for about 90% of non-defense science and technology funding. No other agency has more than 5%. Agriculture has 3%. It is clear from these figures that defense technology is a priority for our nation, followed by biomedical research and space programs. The Department of Energy operates major science user facilities for investigators funded by all other agencies – facilities such as research reactors, particle accelerators, and x-ray synchrotron light sources. About 40% of all funding for physical science is supported through DOE.

As for priority fields, they are similar to those of all other developed countries: biotechnology, nanotechnology, and information technology, and related areas of science, are all priorities. In more applied areas, certain topics in energy research (e.g. hydrogen fuel issues, renewable energy sources), environmental research (e.g. climate studies, environmental remediation), and space exploration are designated priorities. Technical workforce issues, including education, training, and retraining, of scientists and engineers at every stage, are important aspects of R&D funding. Efforts to improve science and math teaching in the lower grades, and to enhance the education and research experience for graduate and post-doctoral students are current priorities.

Research and development in the U.S. private sector is approximately twice the federal investment, bringing the total from all sectors to something over 2.7% of GDP. Private sector research is greatest in pharmaceutical and electronics industries, but is significant in others, including information technology, aerospace, and transportation sectors.

U.S. researchers engage in many collaborations with researchers from other countries, and some agencies have offices specifically devoted to international research programs. The NIH Fogarty Center, for example, gives grants to foreign investigators exclusively. NSF also provides support for foreign researchers. Information on these programs is available on the agency websites. In general, however, the funds available for foreign research are small. The U.S. is making a significant contribution to the CERN Large Hadron Collider project, and has agreed to participate in the international fusion program ITER at the 10% level. Many other smaller programs exist in practically every field of science.

The U.S. innovation process

Economic analyses have shown that the U.S. innovation process depends upon federally sponsored basic and applied science that produces emergent technologies that are subsequently developed with private industry funds. A feature of this process that differs from many other countries is the joining of federally funded research with graduate level training in science and engineering at state and private universities. Most of this work is funded through competitive, peer reviewed proposals funded on their merits by the "big five" science agencies: DOD, NIH, NASA, NSF, and DOE. Even in the federal national laboratories, much of the research is funded on a competitive basis. Most American college students are enrolled in state-sponsored institutions, and the larger states have been generous in their support for facilities in which federally sponsored research can be conducted. Thus federal R&D funds are magnified by state contributions. Most private research universities, and some public ones, also receive substantial support for facilities from private donors, both individuals and corporations.

In general, the role of federal funding is to support long lead-time, high risk research, and the role of the private sector is to fund short lead-time, low risk research. There is a gray area where the two overlap, and this area is somewhat contentious. Agency programs are explicitly evaluated by the White House Office of Management and Budget on this criterion, and programs thought to be funding short term, low risk research are rated down. Technology transfer from university and federal laboratories is encouraged, however, as a matter of policy. Congress passed laws in the 1980's giving ownership to universities and federal laboratory operators of intellectual property developed with federal funds. This arrangement has stimulated technology transfer efforts during the past twenty years.

The innovation process is not completely defined or characterized. Important components include a business climate favorable to entrepreneurship, including access to venture capital and a society that does not regard business failure as a disgrace. Many successful entrepreneurs have a history of multiple failures before they succeed. Certainly the quality and availability of higher education in the U.S. is an important component of successful innovation, as well as the personal freedoms associated with American traditions and constitutional structure.

Roles of public and private capital in innovation

I have already said something about the roles of public and private capital. This Administration favors tax incentives for private sector investments in research and experimentation. As I have indicated, private research outspends public research by a factor of two to one.

These brief remarks cannot do justice to a system of science-driven technology-intensive innovation that continues to drive the U.S. economy at an extraordinary pace. I would be glad to answer specific questions about any of these topics, if I can.