CHAPTER ONE

INTRODUCTION

"Yet, in holding scientific research and discovery in respect, as we should, we must also be alert to the equal and opposite danger that public policy could itself become the captive of a scientific technological elite. It is the task of statesmanship to mold, to balance, and to integrate these and other forces, new and old, within the principles of our democratic system—ever aiming toward the supreme goals of our free society."
—President Dwight D. Eisenhower, Farewell Address, 1/17/61

In the fifty years since the end of World War II and the establishment of a national policy for Government support of scientific research in colleges and universities,[6] historical trends and events have changed the public expectations for Federal research investments. The most important historical event affecting the national post-World War II consensus on Federal participation in science and technology is the end of the Cold War. Until that time, the rationale for Federal investments in research relied heavily on the contributions of science and technology (S&T) to a strong national defense.

The last few Federal budget years have been favorable to research, but a favorable budget in one or two fiscal years does not obviate the need for a coherent post-Cold War Federal policy and decision process to guide investment in S&T. It is difficult to envision a reversal of the tide of accelerating competition among exploding scientific opportunities and between science and other worthy claimants on the budget. Today's environment demands more effective management of the Federal portfolio for research, including a sustained advisory process that incorporates systematic involvement of participants in the U.S. research enterprise, including the science and engineering communities, Federal agencies that fund research, industry, nonprofit organizations that fund and perform research, and, increasingly, state governments. Expert input is particularly important for decisions on long-term, high-risk investments in research–-sponsored mainly by the Federal Government-–which are steadily losing ground in the national research portfolio to short-term investments.

The Federal commitment to research over the last half-century has contributed to a continuous outpouring of benefits to the public from advances in science and technology. Furthermore, within the last few decades these benefits have become increasingly visible and pervasive, from economic growth driven by high technology industries, to science and technology based transformations in many areas of public and private life—including, among others, the revolution in communications and information technologies, major medical breakthroughs, and superior defense technology demonstrated in the field. These transforma-

---

[6] Vannevar Bush, *Science—The Endless Frontier* (National Science Foundation 40th Anniversary edition) Washington DC: National Science Foundation, 1990.

PROCESS FOR PRODUCING THE REPORT

The study responds to the House Committee on Appropriations FY 1999 report urging the Board to undertake the study and the encouragement from Office of Management and Budget (OMB) for this effort. The Board Ad Hoc Committee on Strategic Science and Engineering Policy Issues was charged to examine the state of the art in budget coordination and priority setting for research across fields of science and engineering in the U.S. and internationally, and to convene appropriate stakeholders to consider the findings of these studies and reviews, to develop recommendations for improved methodologies for coordination and priority setting in the Federal research budget and for building the support of the science and engineering communities and the public for these methodologies. The study included two literature reviews:

- Federal research budget coordination and priority setting
- International models of science and technology budget coordination and priority setting.

The Committee heard presentations by invited experts addressing the following methodologies and topics:

- International models for S&T budget coordination and priority setting; a one-and-a-half day Symposium was held in November, 1999, opened by the U.S. President's Science Advisor, with presentations by officials for eight foreign governments: the United Kingdom, Germany, France, Sweden, the Republic of Korea, Japan, Brazil, and the European Union;
- A project to develop a more complete and accessible database for tracking Federal R&D funding, the RaDiUS database, and data issues in tracking S&T activities in the Federal budget;
- Foresight methods, used by many countries as part of the dialogue toward establishing priorities for S&T;
- The Federal Science and Technology (FS&T) budget analysis by the Committee on Science, Engineering and Public Policy (COSEPUP) of the National Academies and the American Association for the Advancement of Science;
- Experiments in international benchmarking of U.S. research fields—undertaken by COSEPUP;
- Approaches to priority setting for research in the academic sector, and the relationship between Federal and academic priority setting;
- Priority setting practices in industry, and the role of industry and the Federal government in national R&D;
- Economic methods to measure the benefits of Federal investments in research and to inform budget allocation decisions, presented by academic experts on economic methods to measure returns on research investments and experts on the Federal budget from the Congressional Budget Office and Council of Economic Advisors.

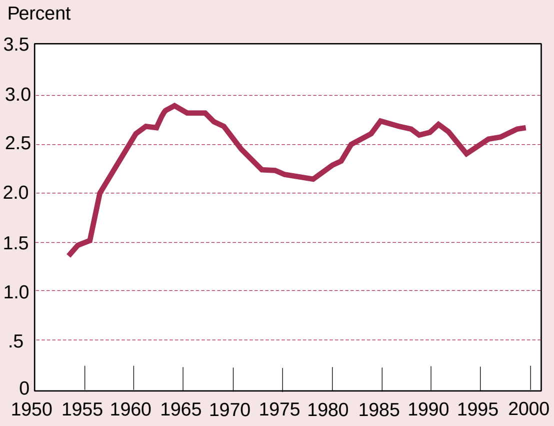
The study included an overview of budget coordination and priority setting in Federal S&T agencies in a August 3-4, 2000 meeting with representatives of the Office of Science and Technology Policy (OSTP), Office of Management and Budget (OMB), Department of Energy (DOE), National Institutes of Health (NIH), National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), U.S. Department of Agriculture (USDA), Environmental Protection Agency (EPA), National Oceanographic and Atmospheric Administration (NOAA), Department of Defense (DOD), Veterans Health Administration (VHA), National Institute of Standards and Technology (NIST), and a discussion with House Appropriations staff.

Finally, the Committee sponsored a stakeholders' symposium on Allocation of Federal Resources for Science and Technology, May 21-22, 2001, focused on the Board-approved discussion document, *The Scientific Allocation of Scientific Resources* (NSB 01-039), containing preliminary recommendations. The report and invitation to the symposium were distributed by webpage, email and mail to members of the stakeholder communities. The symposium included 20 speakers and panelists and encouraged active audience participation. It was attended by more than 200 members of the stakeholder communities including representatives from Congressional staff, science policy organizations, Federal agencies, academic organizations, scientific community organizations, science media, industry representatives and interested individuals.

tions underscore the value of sustained public investments reaching back decades. Moreover, even as the Federal share of funding has declined in national research and development (R&D), non-Federal sectors of the economy—industry, academe, state and non-profit—have come to rely on the Federal Government to play a critical role in funding long-term investments in science and engineering discovery, education and innovation.

The success of the U.S. in encouraging the growth of its high technology industrial sector through public funding for science and engineering research and advanced education led to the U.S. system becoming a widely emulated international model. As Federal Reserve Chairman Alan Greenspan[7] noted: " . . . the research facilities of our universities are envied throughout the world . . . The payoffs in terms of the flow of expertise, new products, and start-up companies, have been impressive." Nonetheless, recognition of the benefits of past public investments does not guarantee public support of the science and technology infrastructure necessary to enable future discoveries that may not yield measurable benefits for decades. Critics and supporters alike note the need for a clearly articulated and compelling rationale for Federal investments in science and technology equivalent in persuasive powers to the rationale of the Cold War.

FIGURE 1:
US R&D/GDP: 1953-2000



Since the 1960s, national expenditures for R&D have been in the range of 2 to 3 percent of GDP

---

[7] Remarks by Chairman Alan Greenspan, "Structural change in the new economy," before the National Governors' Association, 92nd Annual Meeting, State College, Pennsylvania, July 11, 2000.