PROPOSAL PRESSURE IN THE 1980s: AN INDICATOR OF STRESS ON THE FEDERAL RESEARCH SYSTEM

INTRODUCTION

The launch of Sputnik marked the beginning of a golden age of Federal support to science. However, those who look to the 1960s as a model for sustaining science in the 1990s yearn for what is unlikely to return.[1] As explored below, the pattern of continued growth in R&D budgets slowed in the 1970s, and the future gives anything but assurance of renewed growth. Given this uncertainty, it is fair to say that the funding environment is not well understood.[2]

The Federal Government will spend $66 billion on research and development (R&D) in fiscal year 1990. Roughly 15 percent will support basic research.[3] Although basic research rarely has immediate applications, history leads to the expectation that an important part of it eventually will. The Federal Government funds basic research precisely because it may render important insights and benefits, and lead to an enhanced quality of life for most of the citizenry.

The research system consists chiefly of the Federal agencies that fund basic research, researchers (e.g., in universities, national laboratories, industry, and nonprofit organizations) who seek agency funding, and the research that results. Interactions among funders, managers, performers, and consumers of basic research endow the system with a dynamic quality. Indeed, that quality is

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1. John Ziman, "Bounded Science" (Review of Smith and Karlesky's The State of Academic Science: The Universities in the Nation's Research Effort), Minerva, vol. 16, 1978, p. 327. The once explosive growth pattern of science (as measured by, e.g., funding, publications, and patents) yielded to a more incremental rate of increase in scientific "cutputs." For a discussion of this transition, see Derek J. de Solla Price, Little Science, Big Science (New York, NY: Columbia University Press, 1963); for a retrospective on Price's predictions, see Susan E. Cozzens, "Derek Price and the Paradigm of Science Policy," Science, Technology, & Human Values, vol. 13, summer and autumn 1988, pp. 361-372.

2. For commentaries, see U.S. Congress, Office of Technology Assessment, Higher Education for Science and Engineering, OTA-BP-SET-52 (Washington, DC: U.S. Government Printing Office, March 1989); and Roger L Geiger, Research Perspectives on Research Universities, a report to the National Science Foundation on the Workshop held at Pennsylvania State University (University Park, PA: Institute for Policy Research and Evaluation, and Center for the Study of Higher Education, 1989).

3. Albert H. Teich et al., Congressional Action on Research and Development in the FY 1990 Budget (Washington, DC: American Association for the Advancement of Science, January 1990). For a retrospective, see Mark V. Nadel, "The Rise of *Political* Science," The GAO Journal, winter 1988/89, pp. 47-53; for a look ahead, see Janice R. Long and Pamela S. Zurer, "President Proposes 7 Percent Increases in Federal R&D Funding for 1991, Chemical & Engineering News, Feb. 12, 1990, pp. 7-13.

reflected in agency programs with changing goals, competition among members of the research work force for funding, and the mechanisms used to determine research emphases and allocate available monies.

While we hear much today about the benefits accruing from basic research (of civilian or military origin),[4] we also hear much about a system under stress: tight budgets, deteriorating facilities, and bleak prospects (especially for young researchers) of gaining or sustaining support for research programs.[5] To examine stress in the system, OTA documents in this paper changes in the 1980s in the phenomenon of "proposal pressure," the number of research proposals submitted v. the number funded, at each Federal agency that operates a competitive grants program. In addition to establishing a baseline on proposal pressure, these data will suggest issues for further study in OTA's ongoing assessment of "Basic Research for the 1990s."[6] This larger study will examine both the policies and mechanisms for awarding research monies and achieving an array of national research goals.

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4. Various policy tools are used to inform Federal decisionmaking on basic research investments. This is reflected in empirical studies of research teams, facilities, and institutions. For a review, see Daryl E. Chubin, "Research Evaluation and the Generation of Big Science Policy, " Knowledge: Creation, Diffusion, Utilization, vol. 9, December 1987, pp. 254-277. As the competitive pressures for the funding of basic research have grown in other countries, so have the advocates of techniques that identify 'hot" and emerging areas of leading-edge research. The chief exponents of this view have been John Irvine and Ben Martin, Foresight in Science: Picking the Winners (London: Frances Pinter, 1984); and the sequel, B.R. Martin and J. Irvine, Research Foresight: Priority-Setting in Science (London: Frances Pinter, 1989). Also see Organisation for Economic Cooperation and Development, Evaluation of Research - A Selection of Current Practice (Paris, France: 1987); and Ciba Foundation, The Evaluation of Scientific Research (Chichester, England: Wiley-Interscience, 1989).

5. Debate tends to emphasize trade-offs: big v. little science, industry-university research centers v. individual investigators, and peer ("merit") reviewed v. "pork barrel" projects. The policy discourse, in turn, shifts toward how to fund, organize, and optimize U.S. investments in scientific research. Congressional interest in national research investments yielded an exploratory OTA document. See U.S. Congress, Office of Technology Assessment, Research Funding as an Investment: Can We Measure the Returns?, OTA-TM-SET-36 (Washington, DC: U.S. Government Printing Office, April 1986).

6. Requested by the Committee on Science, Space, and Technology, U.S. House of Representatives, this assessment began in December 1989. It is scheduled for completion in February 1991. A copy of the request letter from Robert A. Roe, Chairman, and Robert S. Walker, Ranking Republican Member, and-the study proposal written in response are available from OTA's Science, Education, and Transportation Program.