

In Search of Evidence-based Science Policy: From the Endless Frontier to SciSIP

Other titles in Annals of Science and Technology Policy

Policies for the Provision of Finance to Science-based Entrepreneurship

Alice Civera, Michele Meoli and Silvio Vismara

ISBN: 978-1-68083-352-2

*The Roles and Impacts of Technical Standards on Economic Growth
and Implications for Innovation Policy*

Gregory Tassej

ISBN: 978-1-68083-316-4

Bureaucratization in Academic Research Policy: What Causes It?

Barry Bozeman and Jiwon Jung

ISBN: 978-1-68083-262-4

Advanced Manufacturing: A New Policy Challenge

William B. Bonvillian

ISBN: 978-1-68083-240-2

In Search of Evidence-based Science Policy: From the Endless Frontier to SciSIP

Albert H. Teich

Institute for International Science and Technology Policy
George Washington University
USA
ateich@gmail.com

now

the essence of knowledge

Boston — Delft

Annals of Science and Technology Policy

Published, sold and distributed by:

now Publishers Inc.
PO Box 1024
Hanover, MA 02339
United States
Tel. +1-781-985-4510
www.nowpublishers.com
sales@nowpublishers.com

Outside North America:

now Publishers Inc.
PO Box 179
2600 AD Delft
The Netherlands
Tel. +31-6-51115274

The preferred citation for this publication is

A. H. Teich. *In Search of Evidence-based Science Policy: From the Endless Frontier to SciSIP*. Annals of Science and Technology Policy, vol. 2, no. 2, pp. 75–199, 2018.

ISBN: 978-1-68083-445-1

© 2018 A. H. Teich

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, mechanical, photocopying, recording or otherwise, without prior written permission of the publishers.

Photocopying. In the USA: This journal is registered at the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by now Publishers Inc for users registered with the Copyright Clearance Center (CCC). The 'services' for users can be found on the internet at: www.copyright.com

For those organizations that have been granted a photocopy license, a separate system of payment has been arranged. Authorization does not extend to other kinds of copying, such as that for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. In the rest of the world: Permission to photocopy must be obtained from the copyright owner. Please apply to now Publishers Inc., PO Box 1024, Hanover, MA 02339, USA; Tel. +1 781 871 0245; www.nowpublishers.com; sales@nowpublishers.com

now Publishers Inc. has an exclusive license to publish this material worldwide. Permission to use this content must be obtained from the copyright license holder. Please apply to now Publishers, PO Box 179, 2600 AD Delft, The Netherlands, www.nowpublishers.com; e-mail: sales@nowpublishers.com

Annals of Science and Technology Policy
Volume 2, Issue 2, 2018
Editorial Board

Editor-in-Chief

Albert N. Link
University of North Carolina at Greensboro
United States

Editors

David Audretsch
Indiana University

William Bonvillian
MIT

Barry Bozeman
Arizona State University

Kaye Husbands Fealing
Georgia Institute of Technology

John Hardin
North Carolina Board of Science and Technology

Mariagrazia Squicciarini
OECD

Wolfgang Polt
Joanneum Research Institute

Nicholas Vonortas
The George Washington University

Editorial Scope

Topics

Annals of Science and Technology Policy publishes survey and tutorial articles in the following topics:

- Literature reviews of technology and innovation policies
- Historical case studies of technology development and implementation
- Institutional histories of technology- and innovation-based organizations
- Analyses of policies attendant to technology development and adoption and diffusion
- Studies documenting the adoption and diffusion of technologies and subsequent consequences
- Studies of public and private research partnerships (cross sectional, over time, or case based)
- Assessments and evaluations of specific technology and innovation policies
- Analyses of ecosystems associated with the technology and/or innovation development
- Cross observational (e.g., cross-agency or cross-country) comparisons of technology and innovation policies

Information for Librarians

Annals of Science and Technology Policy, 2018, Volume 2, 4 issues. ISSN paper version 2475-1820. ISSN online version 2475-1812. Also available as a combined paper and online subscription.

Contents

Glossary of Abbreviations and Acronyms	3
1 Introduction	9
2 Origins of Postwar Science Policy	12
3 Science Policy in the Post-Sputnik Era	21
3.1 MIT conference on science and policy	22
3.2 Initial NSF grants for science policy	23
3.3 NSF funding for university science policy and planning	25
4 Science Policy in Academia: Building a Community	28
4.1 Stirrings of a science policy community	30
4.2 A “science and public policy studies group” is formed	32
4.3 The growth of science policy in academia	35
4.4 Science policy becomes a profession	39
4.5 Science policy funding beyond NSF	44
4.6 Student-led science policy	48
5 Growth and Decline of Support for Science Policy Research in the Federal Government	52
5.1 Reorganization of NSF’s science policy activities	52

5.2	NSF support for applied research	54
5.3	NSF's R&D Assessment program	56
5.4	The R&D Assessment program (RDA) becomes part of the new division of Policy Research and Analysis (PRA)	62
5.5	Contributions of PRA to science policy research	63
5.6	The Bloch-House nexus and the "shortfall" controversy	65
6	Science Policymaking and Science Policy Research	70
6.1	Research in the Congressional Office of Technology Assessment	71
6.2	Research in OSTP's think tank, the Science and Technology Policy Institute (STPI)	73
7	Renaissance of Science Policy Research	76
7.1	The Marburger initiative	77
7.2	A "Science of Science Policy" program is created in NSF	84
7.3	A roadmap for the new program	88
8	Reflections	92
8.1	Everything old is new again: The Science of Science Policy in historical perspective	92
8.2	But some things really are new	98
8.3	The expanding horizon of science and innovation policy	101
8.4	Does SciSIP Matter?	106
8.5	Marburger's legacy and the future of science policy research	109
	Acknowledgments	113
	References	116
	Author Biography	124

In Search of Evidence-based Science Policy: From the Endless Frontier to SciSIP

Albert H. Teich

Institute for International Science and Technology Policy, George Washington University, USA; ateich@gmail.com

Disclaimer: This material is based in part upon work supported by the National Science Foundation under Grant Number 1643037. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

ABSTRACT

The federal government invests billions of dollars every year in scientific research. How to allocate this money among fields, institutions, researchers, and projects; how to nurture the talent needed to conduct research at the frontiers of science; how to assess the results of research; and how to translate those results into useful products and services — answering these questions and others are the jobs of science and innovation policy.

In a 2005 speech, presidential science adviser John H. Marburger III suggested that the science policy community was not equipped with tools for such jobs and challenged it to “grow up, and quickly” so it could provide useful guides to action in our “global, technology-based society.” Growing up has meant becoming more empirical, evidence-based, and, in many instances, quantitative.

This paper tracks the evolution of U.S. science policy research largely as it has been conducted in universities and supported by the National Science Foundation, from its beginnings in the early 1960s to the present time, from reliance on expert opinion to more systematic, empirical studies. It examines how a community developed, the growth and decline of federal support, the emergence of the SciSIP (Science of Science and Innovation Policy) program and the ways in which that program has fostered new approaches to science policy. It concludes that the tools and data sets being created by program researchers can have significant impacts on policy, not just in science and technology, but in other fields as well.

Glossary of Abbreviations and Acronyms

AAAS — American Association for the Advancement of Science

AEC — Atomic Energy Commission, a U.S. government agency (1947–1974) later split in two. One part was eventually incorporated into the Department of Energy, the other became the Nuclear Regulatory Commission

ARRA — American Recovery and Reinvestment Act of 2009, commonly known as the “the Stimulus”

BCS — Division of Behavioral and Cognitive Sciences, a unit of the National Science Foundation’s Directorate of Social, Behavioral, and Economic Sciences

BOB — Bureau of the Budget, U.S. government agency (1921–1974) renamed the Office of Management and Budget (OMB) in 1974

CASP — Catalysts for Science Policy, a student-run organization at the University of Wisconsin, Madison

COSEPP — AAAS Committee on Science, Engineering, and Public Policy

COSEPUP — National Academy of Sciences Committee on Science, Engineering, and Public Policy, originally COSPUP

DOE — U.S. Department of Energy, incorporated most of the non-regulatory functions of the Atomic Energy Commission

EPP — Department of Engineering and Public Policy at Carnegie Mellon University

ESEP — Engaging Scientists and Engineers in Policy, a coalition of organizations hosted by AAAS to encourage scientists and engineers to become involved in policy

ERDIP — Experimental R&D Incentives Program, a program run by the National Science Foundation in the mid-1970s

ETIP — Experimental Technology Incentives Program, a program run by the National Bureau of Standards from 1972 to 1980; counterpart to ERDIP

FFRDC — Federally Funded R&D Center

GPRA — Government Performance and Results Act, a federal law enacted in 1993, intended to improve government effectiveness

GSF — Global Science Forum of the Organization for Economic Cooperation and Development (q.v.), originally the Megascience Forum, created in the early 1990s

GUIRR — Government–University–Industry Research Roundtable, a high-level discussion forum at the National Academies of Science, Engineering, and Medicine

IDA — Institute for Defense Analyses, a not-for-profit corporation that operates three FFRDCs, including STPI (q.v.)

IRIS — Institute for Research on Innovation and Science, a university consortium housed at the University of Michigan’s Institute for Social Research providing an institutional home for the UMETRICS project (q.v.)

IRRPOS — Interdisciplinary Research Relating to the Problems of Society, an NSF program initiated in 1970 to expand NSF’s efforts in applied research; it was soon superseded by the much larger RANN (Research Applied to National Needs) program

ITG — Interagency Task Group on the Science of Science Policy, a committee of the National Science and Technology Council that developed a “roadmap” for the Science of Science Policy

MIT — Massachusetts Institute of Technology

NAS — U.S. National Academy of Sciences

NASA — U.S. National Aeronautics and Space Administration

NBS — National Bureau of Standards, a unit of the U.S. Commerce Department, renamed the National Institute of Standards and Technology (NIST) in 1988

NCSES — National Center for Science and Engineering Statistics, a unit of NSF, formerly Science Resources Statistics (SRS)

NIH — National Institutes of Health, an agency within the U.S. Department of Health and Human Services (DHHS) that supports biomedical research in both intramural and extramural programs

NIST — National Institute of Standards and Technology, see NBS

NRC — National Research Council, operating arm of the U.S. National Academies of Science, Engineering, and Medicine; also the U.S. Nuclear Regulatory Commission

NSF — National Science Foundation, principal funding agency for basic research in the United States

NSPG — National Science Policy Group, a consortium of student-led science policy clubs and organizations at U.S. universities

NSTC — National Science and Technology Council, an interagency cabinet-level council, staffed by OSTP, that coordinates science and technology policy across the major R&D agencies of the U.S. federal government

NTO — New Technology Opportunities Program, a Nixon Administration program development exercise in the early 1970s, never implemented, intended to apply technologies of the space program to earth-bound problems

OECD — Organisation for Economic Cooperation and Development, an intergovernmental organization of 35 industrialized countries, the purpose of which is to promote economic and social development policies

OMB — Office of Management and Budget, the unit of the Executive Office of the President responsible, on behalf of the President, for the federal government's budget, as well as management and regulatory issues; formerly BOB

ONR — Office of Naval Research, responsible for the U.S. Navy's science and technology programs, leading government funding agency for basic research in the early post-World War II years

OPA — Office of Planning and Assessment in NSF, absorbed the Division of Policy Research and Analysis (PRA) in 1991, dissolved in 1995

OPS — Office of Policy Support in NSF, successor to the Office of Planning and Assessment (OPA), principally engaged in fulfilling NSF's responsibilities under the Government Performance and Results Act

OST — Office of Science and Technology, part of the Executive Office of the President, succeeded the Office of the Science Adviser in 1962, abolished by President Nixon in 1973

OSTP — Office of Science and Technology Policy, key science policy institution in the U.S. federal government, established by congressional legislation in 1976; replacing the functions of OST; director of the Office is usually the Assistant to the President for Science and Technology

OTA — Congressional Office of Technology Assessment, created by Congress in 1972, "defunded" in 1995

PRA — NSF Division of Policy Research and Analysis (1977–1995)

PSAC — President's Science Advisory Committee, eliminated by President Nixon in 1973, recreated by Congress in 1976 as PCAST, the President's Council of Advisors on Science and Technology

RANN — NSF Program of Research Applied to National Needs (1972–1977)

RDA — NSF R&D Assessment Program, created in 1972, succeeded by the Division of Policy Research and Analysis (PRA)

SBE — NSF Directorate for Social, Behavioral, and Economic Sciences

SciSIP — NSF Program of Science of Science and Innovation Policy, if you don't know this by now you are not paying attention

SEPA — Science and Education Policy Association, a New York City based, student-run organization

SEPP — Science, engineering, and public policy

SES — Social and Economic Sciences, one of three divisions of the NSF Directorate for Social and Behavioral Sciences (SBE)

SPEaC — Science Policy, Education, and Communication Club, a student organization at the University of Texas Southwestern Medical Center

SPI — Science Policy Initiative, a student organization at MIT

SPPSG — Science and Public Policy Studies Group, a community-building organization founded in 1969 that brought together (mainly) academics interested in science policy; was absorbed by AAAS and became COSEPP, a Board committee, in 1973

SRS — NSF's statistical unit, originally Science Resources Studies, later Science Resources Statistics; subsumed by NCSES, the National Center for Science and Engineering Statistics, by legislation in 2010

SST — Supersonic Transport aircraft, a government–industry collaborative project killed by Congress in 1971

STAR METRICS — “Science and Technology in America's Reinvestment — Measuring the Effect of Research on Innovation, Competitiveness, and Science”; a project spawned by SciSIP for assessing the impact of federal R&D by drawing information from existing data from R&D institutions

STPI — Science and Technology Policy Institute, a think tank operated by the Insititute for Defense Analyses (IDA) for OSTP and other federal agencies, originally called the Critical Technologies Institute (CTI)

STPO — Science and Technology Policy Office, the staff office for the President's science adviser during the years when he was located in NSF (1973–1976)

STS — Science, Technology and Society, as an academic field and an NSF program; also Science and Technology Studies

SUP — NASA’s Sustaining University Program; provided institutional support to universities for space-related research in the 1960s

THA — Technology and Human Affairs program, later a department, at Washington University in St. Louis

UMETRICS — “Universities Measuring the Effects of Research on Innovation, Competitiveness and Science,” a project sponsored by a university coalition to measure the impacts of research in universities on innovation, competitiveness, and science using big data technology and methods

1

Introduction

One of the aims of recent science of science policy activities is to develop the evidentiary basis for decision making by policy practitioners.

— *The Science of Science Policy: A Handbook*¹

The annual AAAS Forum on Science and Technology Policy has been keynoted by the President's science advisor nearly every year since it originated in 1976. In most years, the science advisor has focused on R&D in the President's proposed budget for the coming fiscal year.

John H. (Jack) Marburger III, science advisor to President George W. Bush, who generally wrote his own speeches, took a somewhat different approach. In 2002, he gave a wide-ranging speech covering the role of OSTP in the wake of the terrorist attacks of 9/11, balance in science funding, the role of the social sciences, and workforce issues — as well as, of course, the budget. His 2003 address was devoted in part to the sticky problem of visa policy for scientists and engineers and the logjams for foreign visitors that resulted from tightened security as the United States responded to the threat of terrorism. His response

¹Fealing *et al.* (2011), p. 4.

to accusations that the Bush Administration was politicizing science highlighted his 2004 address.

The memory of most of Marburger's Forum speeches has faded with the passage of time, but his 2005 keynote stands out, at least to those whose professional roles involve the practice or study of science policy. In that year, he turned to a subject that increasingly concerned him as he delved more deeply into the issues he faced: the lack of quantitative models and tools for making decisions on science policy. This talk, which Marburger followed up a month later with an editorial in *Science*, marked the birth of an emerging interdisciplinary research area that soon became known as the "science of science policy."²

As one of the organizers of the AAAS Forum, I sat in my seat in the Amphitheater in the Ronald Reagan Building among the 500 or so Forum attendees listening in wonderment to Marburger critique what he called "the nascent field of the social science of science policy" and tell the audience, many members of which had long and distinguished careers in science policy, that it "needs to grow up, and quickly, to provide a basis for understanding the enormously complex dynamic of today's global technology-based society." My first thoughts were "Where has this guy been for the past 50 years? And what does a physicist really know about the field of science policy, anyway?"³

But, in fact, Marburger had a more sophisticated view of the field than his talks suggested and his deliberately provocative remarks planted a seed. And the seed has sprouted. The science of science policy, subsequently re-christened by the National Science Foundation as the "Science of Science and *Innovation* Policy" or "SciSIP," has infused new thinking and new money into the science policy research community. Although he was certainly not the only one to make the

²All seven of Marburger's Forum addresses as well as his editorial can be found in Marburger (2015), pp. 126–202.

³I was not the only one who had this reaction. As Susan Cozzens, professor in the School of Public Policy at Georgia Tech, and a distinguished scholar of science policy, has written, "The science policy researchers in the audience were amazed that Marburger was not aware of the decades of work that had been done." Cozzens (2010).

point, Marburger was right in calling for better tools and models and a stronger base of empirical research in science policy.⁴

Why, one might ask, in a field that has been actively pursued since the early post-World War II years, does not such a base — a solid evidentiary, research base in science policy — already exist? Or does it exist and just lack a connection to the practitioners of science policy? And is a “*science* of science policy” even possible? The purpose of this paper is to suggest answers to these questions by examining the evolution of science policy research in the US federal government and academic world from the late 1940s to the present.

⁴According to Ann Carlson, one of his close advisors, Marburger’s intent in this speech was to “shake things up” with a provocative challenge to the science policy community, which he saw as too conservative and slow to adopt new tools and methods (Personal communication, October 16, 2017).

References

- Alfred P. Sloan Foundation (1966). *Annual Report*.
- Alfred P. Sloan Foundation (1967). *Annual Report*.
- Alfred P. Sloan Foundation (1968). *Annual Report*.
- Alfred P. Sloan Foundation (1972). *Annual Report*.
- Alfred P. Sloan Foundation (1973). *Annual Report*.
- Alfred P. Sloan Foundation (1977). *Annual Report*.
- Alfred P. Sloan Foundation (1981). *Annual Report*.
- Alfred P. Sloan Foundation (1990). *Annual Report*.
- American Association for the Advancement of Science (1990). *Guide*.
Second Edition.
- American Association for the Advancement of Science (1995). *Guide*.
Third Edition.
- American Association for the Advancement of Science, Committee on
Science, Engineering and Public Policy (1985). *Guide to Education
in Science, Engineering and Public Policy*. AAAS.
- Bean, A. S., D. D. Schiffel, and M. E. Mogee (1975). "The Venture
Capital Market and Technological Innovation". *Research Policy*.
4(4).
- Bimber, B. (1996). *The Politics of Expertise in Congress: The Rise
and Fall of the Office of Technology Assessment*. Albany, NY: State
University of New York Press.

- Blair, P. D. (2014). *Congress's Own Think Tank: Learning from the Legacy of the Office of Technology Assessment (1972–1995)*. New York: Palgrave Macmillan.
- Blankenship, L. V. and W. H. Lambright (1980). "Applying University Research to National Needs: Lessons for NASA-SUP and NSF-RANN". reprinted in U.S. House of Representatives, Committee on Science and Technology, *H.R. 6910, National Technology Foundation Act of 1980*, Hearings, September.
- Blanpied, W. A. (1998). "Inventing US Science Policy". *Physics Today*. 51(2).
- Blanpied, W. A. (2010). *A History of Federal Science Policy from the New Deal to the Present*. Houston: Rice University Press.
- Bowers, R. (1974). "Report of the Committee on Science and Public Policy of the American Association for the Advancement of Science". Unpublished document obtained from the AAAS Archives.
- Brode, W. R. (1971). "Manpower in Science and Engineering, Based on a Saturation Model". *Science*. 173(16 July).
- Brown, L. D., T. J. Plewes, and M. A. Gerstein, eds. (2004). *Measuring Research and Development Expenditures in the U.S. Economy*. Washington, DC: National Academy Press.
- Committee on Institutional Cooperation (2016). "UMETRICS". <https://www.cic.net/projects/umetrics>, February 18.
- Committee on the Social Sciences in the National Science Foundation, Assembly of Behavioral and Social Sciences, National Research Council (1976). *Social and Behavioral Science Programs in the National Science Foundation*. Washington, DC: National Academy of Sciences.
- "Congress Ends U.S. Funding of Supersonic Aircraft" (1972). In: *CQ Almanac 1971*. Washington, DC: Congressional Quarterly. 08-130-08-140. URL: <http://library.cqpress.com/cqalmanac/cqal71-1252799>.
- "Congressional Roundup" (1969). *SPPSG Newsletter*. 1(Nov.).
- Cozzens, S. E. (2010). "Science and Innovation Policy Studies in the United States: Past and Present". Paper Prepared for the Center for Management and Strategic Studies (CGEE), Brazil, March 21.
- Critical Technologies Institute (1997). *Annual Report*. Washington, DC: CTI.

- de Solla Price, D. (1969). "Letter to the Editor". *SPPSG Newsletter*. 1(November).
- de Solla Price, D. J. (1965). "The Scientific Foundations of Science Policy". *Nature*, 4981. April 17.
- England, M. (1982). *A Patron for Pure Science: The National Science Foundation's Formative Years, 1945-57*. Washington, DC: National Science Foundation.
- Falk, C. E. (1968). "Science and Public Policy Activities in Universities". *Bulletin of the Atomic Scientists*. 24(6).
- Fealing, K. H., A. S. Beatty, and C. F. Citro, rapporteurs (2014). *Science of Science and Innovation Policy: Principal Investigators' Conference Summary*. Washington, DC: National Academy of Sciences.
- Fealing, K. H., J. I. Lane, J. H. Marburger III, and S. Shipp, eds. (2011). *The Science of Science Policy: A Handbook*. Stanford, CA: Stanford Business Books.
- Feldman, M. (2017). "Beyond Patents: Recent Work from [the] NSF Science of Science & Innovation Policy (SciSIP) Program". In: *Beyond Patents: Assessing the Value and Impact of Research Investments*. presentation at a meeting of the Government-University-Industry Research Roundtable. National Academy of Sciences Building, Washington, DC.
- Geiger, R. L. (1993). *Research and Relevant Knowledge: American Research Universities Since World War II*. New York: Oxford University Press.
- Greenberg, D. S. (2001). *Science, Money, and Politics: Political Triumph and Ethical Erosion*. Chicago: University of Chicago Press.
- Hall, M. J., S. K. Layson, and A. N. Link (2014). "The Returns to R&D: Division of Policy Research and Analysis at the National Science Foundation". *Science and Public Policy*. 41(4).
- Halloran, Jr., J. W. (2015). "Coordinating Science: White House Office of Science and Technology Policy (OSTP) Influence in Federal R&D Budgets". M.S. Thesis, Department of Political Science, MIT. <http://hdl.handle.net/1721.1/101807>.
- Hounshell, D. (1997). "The Cold War, RAND, and the Generation of Knowledge, 1946-1962". *Historical Studies in the Physical and Biological Sciences*. 27(2): 237-267.

- Institute of Medicine, National Academy of Sciences, and National Academy of Engineering (1992). *Fateful Choices: The Future of the U.S. Academic Research Enterprise*. <https://doi.org/10.17226/1980>. Washington, DC: The National Academies Press.
- Koizumi, K. (2011). "Science Policy: A Federal Budgeting View". In: *The Science of Science Policy: A Handbook*. Ed. by K. H. Fealing et al. Stanford, CA: Stanford Business Books. Chap. 14.
- Lambright, W. H. (1969). *Launching NASA's Sustaining University Program*. Syracuse, NY: Inter-University Case Program.
- Lane, J. I., J. Owen-Smith, R. F. Rosen, and B. A. Weinberg (2015). "New Linked Data on Research Investments: Scientific Workforce, Productivity, and Public Value". *Research Policy*. 44.
- Lane, J. and S. Bertuzzi (2011). "Measuring the Results of Science Investments". *Science*. 331(6018).
- Larsen, O. N. (1992). *Milestones and Millstones: Social Science at the National Science Foundation, 1945-1991*. New Brunswick: Transaction Publishers.
- Leahey, E. and C. L. Cain (2013). "Straight from the Source: Accounting for Scientific Success". *Social Studies of Science*. 43(6).
- Leonard L. Lederman in Karl A. Stroetmann (1977). *Innovation, Economic Change and Technology Policies*. New York: Springer-Link.
- Lewis, H. J. (1971). "Science Foundation Takes a New Cut at Science Policy Studies". *SPPSG Newsletter*. 2(7).
- Lewis, H. J. (1973). "Two Approaches to a National Technology Policy". *Public Science*. 4(4).
- Logsdon, J. M. (2015). *After Apollo? Richard Nixon and the American Space Program*. New York: Palgrave Macmillan.
- Macilwain, C. (2011). "Stimulus-Response". *Nature*. 477(29 September).
- Mansfield, E. (1977). "Introduction and Summary". In: *Preliminary Papers for a Colloquium on Relationships Between R&D and Economic Growth/Productivity*. Ed. by R. P. Piekarz. National Science Foundation.
- Marburger III, J. H. (2005a). "Wanted: better benchmarks". *Science*. 308(May 20).

- Marburger III, J. H. (2005b). "Toward an Improved Framework for Understanding Science Indicators". Paper presented at the G-8 meeting, May 27, 2005. John H. Marburger III Collection, Box 35, Stony Brook University Special Collections and University Archives, Stony Brook University, N.Y.
- Marburger III, J. H. (2015). *Science Policy Up Close*. Cambridge, MA: Harvard University Press, Robert P. Crease ed.
- Marburger III, J. H. and J. B. Bolten (2005). "Memorandum for the Heads of Executive Departments and Agencies on FY 2007 Administration Research and Development Budget Priorities".
- Mervis, J. (1991). "Congress Presses Probe into NSF Prediction of Scientist Shortage". *The Scientist*. Oct. 28.
- Mervis, J. (2009). "When Counting Jobs Isn't Enough". *Science*. 326(5954).
- Mervis, J. (2016). "NSF Proposes Changes in Use of Costly Rotators for Senior Positions". *Science* online. Sept.
- National Academy of Sciences (1978). *The National Academy of Sciences: The First Hundred Years, 1863–1963*. Washington, DC: National Academy Press.
- National Research Council, Committee on National Statistics, Division of Behavioral and Social Sciences and Education (2014). *Science of Science and Innovation Policy: Principal Investigators' Conference Summary*. Washington, DC: The National Academies Press.
- National Science Foundation (1951). *First Annual Report, 1950–1951*. Washington, DC: NSF.
- National Science Foundation (1953). *Third Annual Report, Year Ending June 30, 1953*. Washington, DC: NSF.
- National Science Foundation (1955). *Fifth Annual Report, 1955*. Washington, DC: NSF.
- National Science Foundation (1960). *9th Annual Report, 1959*. Washington, DC: NSF.
- National Science Foundation (1962). *11th Annual Report, 1961*. Washington, DC: NSF.
- National Science Foundation (1967). *17th Annual Report, 1967*. Washington, DC: NSF.

- National Science Foundation (1969). *18th Annual Report, 1968*. Washington, DC: NSF.
- National Science Foundation (1972). *Research and Development and Economic Growth/Productivity, Papers and Proceedings of a Colloquium*. NSF 72-303. Washington, DC: US Government Printing Office.
- National Science Foundation (1977). *Twenty-Sixth Annual Report for Fiscal Year 1976*. Washington, DC: U.S. Government Printing Office.
- National Science Foundation, Directorate for Scientific, Technological and International Affairs, Division of Policy Research and Analysis (1989). *The State of Academic Science and Engineering*. NSF 90-35. Washington, DC: NSF.
- National Science Foundation, Scientific, Technological, and International Affairs Directorate, Office of National R&D Assessment (1976). *Technological Innovation and Federal Government Policy: Research and Analysis of the Office of National R&D Assessment*. NSF 76-9. Washington, DC: National Science Foundation.
- National Science Foundation, Social, Behavioral and Economic Sciences (2006). "Science of Science and Innovation Policy: A Prospectus".
- Nixon, R. M. (1971). *Address to the Congress on Stabilization of the Economy*. Sept. 9.
- Office of Science and Technology Policy, National Science and Technology Council, Committee on Science, Subcommittee on Social, Behavioral and Economic Sciences (2008). *The Science of Science Policy: A Federal Research Roadmap*. Washington, DC.
- Olsen, K. L. (2003). "The S&T Workforce: Improving the Data System for Decision-Making". Remarks at the RAND STPI [Science and Technology Policy Institute] Workshop.
- Organisation for Economic Co-Operation and Development, Directorate for Science, Technology and Industry, Committee for Scientific and Technological Policy, Global Science Forum (2006). *Summary of the Workshop on Science of Science Policy: Developing Our Understanding of Public Investments in Science*. 12 July 2006, Helsinki Paris.

- Piekarz, R. P. (1977). "Introduction and Summary". In: National Science Foundation. *Preliminary Papers for a Colloquium on Relationships Between R&D and Economic Growth/Productivity*.
- Price, D. K. (1962). *Government and Science*. New York: Oxford University Press.
- Price, D. K. (1965). *The Scientific Estate*. Cambridge, MA: Harvard University Press.
- Sarewitz, D. (2007). "Does Science Policy Matter?" *Issues in Science and Technology*. 23(4).
- Seltzer, R. (1991). "Democrats Push Critical Technologies Bills". *Chemical & Engineering News*. 25(June).
- Skolnikoff, E. (1968). "Science and Public Policy Meeting at AAAS". *Bulletin of the Atomic Scientists*. 24(6).
- Stokes, D. (1997). *Pasteur's Quadrant: Basic Science and Technological Innovation*. Washington, D.C.: The Brookings Institution.
- Tasse, G. (2014). "Innovation in Innovation Policy Management: The Experimental Technology Incentives Program and the Policy Experiment". *Science and Public Policy*. 41.
- Teich, A. H. (1985). "Federal Support of Applied Research: A Review of the U.S. Experience". In: National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Papers Commissioned for a Workshop on the Federal Role in Research and Development*. Washington, DC: The National Academies Press. URL: <https://doi.org/10.17226/942>.
- Teich, A. H. (2012). "Making Policy Research Relevant to Policy". prepared for the National Academy of Sciences, November 2012, available at <http://bit.ly/2gjw4Od>.
- Teich, A. H. and I. Feller (2011). *Building a Community of Practice II: Report on the Second AAAS-NSF SciSIP Workshop*. Washington, DC: American Association for the Advancement of Science.
- Teich, A. H., B. D. Gold, and J. M. Wiaz (1986). *Graduate Education and Career Directions in Science, Engineering and Public Policy*. Washington, DC: AAAS.
- US Congress, Office of Technology Assessment (1991). *Federally Funded Research: Decisions for a Decade*. OTA-SET-490 Washington, DC: U.S. Government Printing Office.

- US Department of Commerce (1967). *Technological Innovation: Its Environment and Management*. Washington, DC: US Government Printing Office.
- US House of Representatives, Committee on Science and Astronautics (1972). *Teaching and Research in the Field of Science Policy: A Survey*. Washington, DC: U.S. Government Printing Office.
- US House of Representatives, Committee on Science and Technology, Task Force on Science Policy (1986). *A History of Science Policy in the United States, 1940–1985*. (Report prepared for the Task Force by Jeffrey K. Stine), Washington, DC: US Government Printing Office.
- US National Science Board (2000). “A History in Highlights: 1950–2000”. <https://www.nsf.gov/nsb/documents/2000/nsb00215/nsb50/start.htm>.
- US President’s Science Advisory Committee (1959). *Strengthening American Science*. US Government Printing Office.
- Wade, N. (1979). “Carter Plan to Spur Industrial Innovation”. *Science*. 206(16 November).
- Waterman, A. T. (1952). “Records of the National Science Foundation (diary note, June 26, 1952), Office of the Director (RG 307, Box 33, General Records 1949–1963, National Archives II)”.
- Weinberg, B. A., J. Owen-Smith, R. F. Rosen, L. Schwarz, B. M. Allen, R. E. Weiss, and J. Lane (2014). “Science Funding and Short-Term Economic Activity”. *Science*. 344(6179).
- Weiss, C. H. (1977). “Research for Policy’s Sake: The Enlightenment Function of Social Research”. *Policy Analysis*. 3(4).
- White, R. M. (2001). “Science, Engineering, and the Sorcerer’s Apprentice. Address to the annual meeting of the National Academy of Engineering, October 2, 1990”. In: *Science, Money, and Politics: Political Triumph and Ethical Erosion*. Chicago: University of Chicago Press.
- Zolas, N., N. Goldschlag, R. Jarmin, P. Stephan, J. O. Smith, R. Rosen, B. M. Allen, B. A. Weinberg, and J. I. Lane (2015). “Wrapping It up in a Person: Examining Employment and Earnings Outcomes for Ph.D. Recipients”. *Science*. 350(6266).
- Zoss, A. M. and K. Borner (2012). “Mapping Interactions Within the Evolving Science of Science and Innovation Policy Community”. *Scientometrics*. 91.

Author Biography

Albert H. Teich is Research Professor of Science, Technology and International Affairs at the Institute for International Science and Technology Policy of George Washington University. Prior to joining the GW faculty in 2012, he served for 21 years as Director of Science & Policy Programs at the American Association for the Advancement of Science. During that time, he was a key spokesman on science policy issues for AAAS and had overall responsibility for the Association's diverse activities in science and technology policy, including the Science and Technology Policy Fellowships, the R&D Budget and Policy Program, the Program of Dialogue on Science, Ethics, and Religion, the Research Competitiveness Program, and the Program on Science and Human Rights. Prior to joining the AAAS staff in 1980, he served in faculty and administrative positions at GW, Syracuse University, and SUNY Binghamton.

Professor Teich's textbook, *Technology and the Future*, first published in 1972, went through 12 editions and was in print for 42 years. His other books include *Science and Technology in the USA* (with Jill H. Pace), *Scientists and Public Affairs* (with several others); and *Science Evaluation and Its Management* (with Václav Pačes, and Ladislav Pivec). His articles have appeared in *Issues in Science and Technology*; *Science*; *Public Administration Review*; *Science, Technology and Innovation Policy Review*; *The Information Society*; and *Slate*; as chapters in

many books; and as op-eds in *The Chronicle of Higher Education*; *The Scientist*; *Süddeutsche Zeitung*; *The San Francisco Chronicle*; and *The Washington Post*.

He has been an invited lecturer to organizations in the United States, Japan, New Zealand, Australia, South Africa, France, United Kingdom, Russia, China, Norway, Sweden, Hungary, Azerbaijan, Switzerland, Romania, Iceland, and Korea. He has testified before several congressional committees and served as a consultant to many government agencies and nonprofit organizations. He has been quoted in *The New York Times*, *The Washington Post*, *Scientific American*, *The Globe and Mail* (Toronto), *The Wall Street Journal*, *Nature*, *Dagens Nyheter* (Sweden), and many other print and electronic media.

He served as a member of the Board of Governors of the US–Israel Binational Science Foundation (BSF) for 18 years, including two terms as Chair. He is a member of the advisory committee to the S&T Fellows program of the California Council for Science and Technology; an honorary member of the Washington Science Diplomats Club; and a member of the Technical Advisory Committee to the Maine Space Grant Consortium.

Professor Teich received the Award for Achievement in Science Policy from the Washington Academy of Sciences in 2004. He was elected a Fellow of AAAS in 1986 and was honored with a *Festschrift* on the occasion of his retirement from AAAS, which was published by AAAS as *The State of Science Policy* in 2013.

He received a B.S. in Physics from M.I.T. and a Ph.D. in Political Science, also from M.I.T.