TPI Technology Policy International, LLC

THINK TANKS AND RELATED RESEARCH AND ANALYSIS ORGANIZATIONS FOR U.S. SCIENCE, TECHNOLOGY AND INNOVATION POLICY

A Report to NEDO

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September 2016

Technology Policy International, LLC

www.technopoli.net

PREFACE

The study underlying this report was commissioned by the Washington, D.C., office of Japan's New Energy and Industrial Technology Development Organization (NEDO) and was conducted by Technology Policy International, LLC.

The opinions expressed in this report do not necessarily reflect the views of NEDO or of other institutions with which the authors are affiliated.

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TABLE OF CONTENTS

THINK TANKS AND RELATED RESEARCH AND ANALYSIS ORGANIZATIONS FOR U.S. SCIENCE, TECHNOLOGY AND INNOVATION POLICY

INTRODUCTION

This report identifies and assesses "think tanks" and related research and analysis organizations in the United States, especially in the Washington, DC, area, that make significant contributions to public policy dialogues regarding science, technology, and innovation policy (STIP). The report is intended as a guide to assist NEDO and others in focusing their attention on key organizations concerned with specific questions or specific perspectives on STI policy.[1]

The report begins with an overview of the concept of a "think tank" and discusses the origin and history of think tanks and related organizations, situating think tanks in the broader context of diverse research and analysis organizations that seek to inform and/or influence public policy making in the United States. The overview also addresses the roles that such organizations play in American public policy making.

Following the overview, we provide a selective catalog of organizations that seem especially important to science, technology and innovation policy. For a smaller number of what we consider to be especially influential organizations among those in the catalog, we present brief descriptions of their strengths and institutional settings. We focus here on organizations that contribute to general STI policy and pay less attention to groups that focus specifically on national security, energy, health, or information and computing issues.

A number of important think tanks and other organizations that address science, technology and innovation policy do so as part of a much broader agenda of policy-related topics. We include such organizations in this report so long as they make significant contributions to science, technology and innovation policy.

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[1] An appendix to this report provides suggestions for effectively accessing the staff, activities and products of think tanks and related organizations.

This report draws on open source materials such as pubic web sites, reports, and other materials, as well as on the collective experience of the authors in serving in and working around such organizations.

OVERVIEW OF THINK TANKS AND RELATED ORGANIZATIONS IN THE UNITED STATES

WHAT IS A THINK TANK?

"Think tank" is an informal term with no legal definition. Various definitions have been used over time.[2] For the purpose of this paper, a think tank is an organization comprised of experts who study and analyze public policy issues, devise and assess alternative approaches to resolution of those issues, including policy alternatives, and communicate the results of their studies, analyses, and considerations of alternatives to decision makers, their staffs, and the public.[3]

Generally, think tanks are staffed by subject matter experts as well as by experts in research and analytical methods, communications, and public outreach. Most maintain at least a façade, if not the reality, of being objective, unbiased, and analytical, rather than seeking to promote or advance a particular policy agenda or set of values. They are usually thought of as operating in the "public interest" rather than in the interests of a particular group or institution. Think tanks typically do independent and original analyses of the issues they address, although often their analyses draw heavily on previous research and studies done by other organizations; sometimes their work might better be characterized as "synthesis" rather than "analysis." In addition, many, but not all, think tanks are multidisciplinary and draw on a range of analytical methods and disciplines as well as on diverse perspectives on the value-laden considerations that are always present in public policy debates.

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[2] For a history of the evolution and debate over the term "Think Tank", see Thomas Medvetz, Think Tanks in America, University of Chicago Press, 2012. The term was first applied in 1958 to the Center for Advanced Study in the Behavior Sciences based at Stanford, but the term has evolved so that this Center is no longer considered a think tank. In the 1970s, the term was applied extensively to U.S. government analytical contractors, but more recently has been applied mostly to independent, non-profit policy research organizations.

[3] A Web search reveals many definitions of think tank, but most are variations on the definition offered above. Recently, Enrique Mendizabal, founder of the collaborative *On Think Tanks* published on line the results of his survey of the literature on the definition of think tanks that offers a useful compendium of concepts, definitions and characteristics of think tanks drawn from his review. The definitions and descriptive categories we use in this report are consistent with the findings from his review. See: "Different Ways to Define and Describe Think Tanks," https://onthinktanks.org/articles/different-ways-to-define-and-describe-think-tanks/ Accessed August 4, 2016.

Think tanks may receive financial support from diverse sources, including individuals, private foundations, governments, and the private sector, as well as from sales of reports and other products of their work.

Some people limit "think tanks" to independent, non-profit organizations, while others include organizations that conduct activities similar to those of think tanks, regardless of their organizational affiliations and structure. In this paper we include as "think tanks" both independent and government-affiliated policy research organizations. We also include, as "related organizations" examples of the myriad of other advisory committees, professional and industry associations, advocacy groups, and others that sometimes function like think tanks.

ORIGINS AND HISTORY OF THINK TANKS AND RELATED ORGANIZATIONS

Organizations similar to modern think tanks began to appear many years before the phrase, "think tank," was used as a name for such organizations. Early examples in the United States are the National Academy of Sciences (established in 1864), the Legislative Reference Service in the Library of Congress (founded in 1914 and renamed the Congressional Research Service in 1970), the Brookings Institution (whose roots are in the Institute of Government Research established in 1916), the National Bureau of Economic Research (established in 1920), the Social Science Research Council (established in 1923), the Cowles Commission for Economic Research--now the Cowles Foundation (established in 1932), the RAND Corporation (established in 1946 in the Douglas Aircraft Corporation and re-established as an independent organization in 1948), and Resources for the Future (established in 1952).

Other than the very early case of the National Academy of Sciences, which was created to provide scientific advice to the Government during the conduct of the American Civil War, the first wave of creation of institutions that came to be thought of as think tanks occurred during the Progressive Era in American politics (roughly the 1890s through the 1920s).[4] The Progressives were reformers who sought, among other things, to professionalize the conduct of public administration and the affairs of governments and to bring the scientific method to bear in understanding public issues and designing ways to address them. It is beyond the scope of this paper to examine the Progressive Era systematically, but we can note that the Progressives

[4] https://en.wikipedia.org/wiki/Progressive_Era

had a great influence on the tone and style of American politics and governance not only in their own time but even up to the present day.[5]

In the years following the Progressive era, the increasing dependence of governance and public administration on science and expertise stimulated creation of many new think tanks in a wide array of policy domains. Among the seminal developments in the midst of the Great Depression of the 1930s were systematic studies of the suspected causes of the Depression and of ways to end it carried out by special commissions of experts acting much like modern think tanks. During World War II, the U.S. military establishment adopted nearly overnight the principles of what became known as "operations research," which is a staple commodity of defense think tanks like RAND, the Institute for Defense Analyses, the Center for Naval Analysis, and many others less-directly connected to the Department of Defense. The Administrative Procedure Act of 1948 codified requirements that Federal regulatory agencies base their policy-making and enforcement actions on the best available evidence, which greatly increased the demands of such agencies for think-tank type studies.[6] In addition to the agencies' needs for data and information to make regulatory decisions, non-governmental entities that have a stake in regulatory decision-making by the government are incentivized by the regulatory process to create and promote their own data and analyses in support of their positions.[7] The Great Society programs of the Johnson-Nixon era in the 1960s and 1970s created demands for new think tanks to provide a sound basis for creating and evaluating social welfare and educational programs of all kinds. By the late 1960s, concerns about the impact of rapid developments in and the use of new technologies brought demands for a new organization to study the effects of new technologies on society and the world; the result was establishment of the Congressional Office of Technology Assessment pursuant to a law passed in 1972.[8]

In 1990 Congress adopted legislation that established the Critical Technologies Institute (now called the Science and Technology Policy Institute, or STPI) to serve as a think tank for the

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[5] A prominent characteristic of present-day American politics is the re-emergence of an older style of "Populist" politics and governance that is skeptical of science and of expertise in any form. Analyzing this development is beyond the scope of this report.

[6] The requirement for high quality data and analysis was reinforced by judicial decisions made in response to law suits filed in connection with adopting and/or enforcing Federal regulations. The courts have ruled that agencies must consider the public record of available and relevant information when taking action, so affected parties are naturally encouraged to supply data and analyses in support of their positions to government agencies.

[7] It is sometimes said that any group that wants to have influence over the regulatory agencies must equip itself with its own report and associated cadre' of experts.

[8] In 1995 Congress eliminated funding for the Office of Technology Assessment.

White House Office of Science and Technology Policy.[9] In keeping with several think tanks that serve government agencies, STPI is today operated as a Federally Funded Research and Development Center (FFRDC) by the Institute for Defense Analyses.[10]

The formation of new think tanks and related organizations has proceeded nearly unabated over the past few decades, with one count suggesting that there are at least 1,500 such organizations in the United States.[11] While a few of these are part of the Federal Government or under its control, most are not. Rather, most are organized, operated, and funded by a wide variety of non-governmental organizations and interests. Such non-governmental organizations are critical contributors to the decentralized, pluralistic scheme of governance that characterizes the United States.

ROLES OF THINK TANKS AND RELATED ORGANIZATIONS IN THE UNITED STATES

As implied by their history and definition, a primary role of think tanks and related organizations is to serve as a source of objective data collection and research, concept building, and policy analysis that is intended to help policymakers and the public craft and adopt more effective public policies.

Think tanks play other important roles as well. They often serve as training grounds for young professionals who intend to move into policymaking roles once they have developed a solid understanding of the relevant public policy systems. Later in their careers, some public policy professionals, especially those who serve in politically-appointed positions in the government, find employment in think tanks during periods when their political party is out of power.

Many think tanks host policy dialogues among experts, decision makers, or both. Such dialogues usually include experts from the host think tank, often along with others from academia, interest groups, other think tanks, and other countries. They also include independent policy professionals, retirees who have served in key policy positions, members of the press, and others who can contribute their expertise to enriching the dialogue. In addition,

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[9] https://en.wikipedia.org/wiki/Science_and_Technology_Policy_Institute

[10] For a discussion of the use of FFRDC contracts to operate study and analysis centers for the U.S. Government, see the TPI report to NEDO, "Institutions to Perform Government R&D," full text on-line at: http://www.technopoli.net/yahoo_site_admin1/assets/docs/Government_RD_Institutions.4184933.pdf

[11] This estimate comes from James G. McGann, editor, Think Tanks and Policy Advice in the US: Academics, Advisors and Advocates, Routledge, 2007. If anything, 1500 seems likely to be a lower bound on the number of such organizations in 2016.

in Washington, think tanks frequently host seminars or speeches by authors of important new books on policy topics, many of which are open to the public.

The press frequently turns to experts in think tanks to provide expert commentary on newsworthy issues of the day. Top-level policy makers, up to and including the President, may invite experts from think tanks to discuss important issues, often in private sessions where experts are asked to provide not only their expertise but also their personal views on the best course of action.

Think tanks can serve as honest brokers of information and views on public policy alternatives, especially when experts from different interest groups have divergent perspectives on issues. They may play this role by hosting debates, doing meta-analyses that systematically compare and contrast the published works of those opposing experts, or otherwise serving as forums for in-depth engagement around differences of view.

THE PURSUIT OF OBJECTIVITY AND THE ABSENCE OF BIAS

Not all think tanks aspire to being objective. In fact, some are organized to provide data and analyses that support and buttress the views of their sponsors. Some such "advocacy think tanks" are quite transparent about what they are doing—they make it clear that they have a point of view, that that point of view supports their sponsors, and that they intend to promote that point of view at every opportunity. Other advocacy think tanks are less transparent—they present their work as if it were objective and free of bias, even though it may incorporate assumptions and frameworks that ensure that study results are in line with their preferences. Even organizations that aspire to be as objective and unbiased as possible find it exceedingly difficult to achieve such a pure state in practice. Furthermore, the expert staff members of think tanks are usually by nature intensely interested in and passionate about public policy issues; otherwise, they would not likely have chosen service at a public policy think tank as a career. It is very challenging for individual authors who have strong views on issues to write about those issues without bringing their implicit biases into their work.

Another factor that influences the objectivity of think tanks is the large amounts of money needed to sustain them. While some think tanks are supported by relatively neutral sources of funds to pay for their work, such as governments or well-established private foundations, others depend heavily on funds from companies, industrial associations, advocacy groups, wealthy individuals, and various foreign interests to sustain them. Over the last few decades, think tanks have become an increasingly important mechanism through which interest groups seek to shape public policy, both through support of advocacy think tanks and through subtle

support of think tanks that purport to be neutral and unbiased.[12] Thus, in judging whether a particular think tank report or other product is objective and free of bias, readers and users need to be aware of both who worked on the study and wrote its report and who paid for it.

Given this background, users of think tank products should not be surprised that the personal preferences of the authors of studies and reports, as well as of their funders and supporters, echo through the work they produce.[13] It is our view that objectivity and lack of bias are laudable goals to which think tanks should aspire, but that they are not goals that a think tank or its authors ever reach.[14]

THINK TANKS IN THE LARGER ECOSYSTEM OF POLICY-RELATED ORGANIZATIONS

As discussed earlier, many other types of policy research and analysis organizations have some of the characteristics of think tanks and/or provide some of the same services to American policymakers and society. It is not always easy to distinguish among these types or to draw a clear line between those that are think tanks and those that are not. Among the closely related types of organizations are:

- Special government commissions and study panels
- Policy and planning bureaus of Federal government departments and agencies
- Congressional special committee staff studies
- Congressional special interest caucuses and Member organizations
- Policy and planning staffs of international financial and other institutions

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[12] Silverstein, Ken, "Pay-to-Play Think Tanks: Institutional Corruption and the Industry of Ideas," June 15, 2014. See: https://drive.google.com/file/d/0B5MMPY9ZYoG1ajB5TjRhRnVCZ2M/edit

[13] Many leading think tanks have elaborate and costly systems that seek to minimize both intended and inadvertent bias in their work. These include extensive use of external advisory panels, review of draft studies by peer colleagues as well as by external experts associated with diverse institutions and points of view, and encouragement of their experts to publish versions of their work in leading peer reviewed journals in order to subject it to the rigor of both pre-publication peer view and post-publication evaluation and critique by much greater numbers of readers. Many think tanks also require disclosure of potential conflicts of interests by all who participate in producing a report or study under their auspices and some even prohibit participation by persons who have evident conflicts of interests.

[14] A recent two-part article in The New York Times details somewhat surprising conflicts of interest at major U.S. think tanks, especially but not only at the Brookings Institution. See: Eric Lipton and Brooke Williams, *"Researchers or Corporate Allies? Think Tanks Blur the Line,"* The New York Times, August 7, 2016, at: http://www.nytimes.com/2016/08/08/us/politics/think-tanks-research-and-corporate-lobbying.html and Eric Lipton, Nicholas Confessore and Brooke Williams, *"Think Tank Scholar or Corporate Consultant? It Depends on the Day,"* The New York Times, August 8, 2016, at: http://www.nytimes.com/2016/08/09/us/politics/think-tank-scholars-corporate-consultants.html

- Management consulting companies
- Data and analysis departments of industrial trade associations and of labor unions
- Issue-based non-profit advocacy organizations
- Research units of political parties and other special interest groups
- Higher education institutions
    - Centers
    - Policy schools
- Public policy offices and special study committees of professional and scientific societies and associations
- Analytical departments of law firms and lobbying and public relations companies
- Non-profit research institutes
- Analytical departments of private foundations

Collectively, across all fields of public policy, there are thousands of such organizations in the United States, many of which have headquarters or offices in the Washington, DC, area. These organizations vary greatly in size, influence, commitment to objectivity versus commitment to a particular policy or program choice, degree of professionalization, and so on. Many of them are held in high regard within the policy and think tank communities; in fact, staff members of these sorts of organizations are often represented within the analytical and outreach activities carried out by think tanks as participants, reviewers, or even sponsors. Other organizations are understood to be heavily biased in support of a particular point of view or set of interests. While their writings can be very useful in understanding how one side sees a controversial issue, they are not usually thought of as reliably disinterested, even-handed or objective.[15]

It is beyond the scope of the present report to review, analyze or catalog all of the other organizations that inhabit the same general "space" as do public policy think tanks. Suffice it to say that an organization may appear to be an objective think tank but may actually use the methods of research and analysis to devise and promote an agenda of policy action that is entirely in the interests of its own constituents and is not focused on the broader public interest.

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[15] It is not easy to determine the degree to which a think tank or other policy research and analysis organization offers objective and unbiased advice and analyses. Furthermore, a judgment about whether a particular organization is unbiased/objective is itself influenced by the biases of the person who is making the judgment. There is no substitute for consultation with a diverse set of experts and observers when one is trying to decide whether an organization is suitably free of bias.

CATALOG OF U.S. THINK TANKS AND RELATED ORGANIZATIONS IN SCIENCE, TECHNOLOGY & INNOVATION POLICY

Here we present a catalog of selected U.S. think tanks and related organizations that specialize in aspects of the fields of science, technology and innovation policy. The catalog is based on the authors' collective knowledge of the think tank and related organization world, supplemented by a systematic Web search of literature in the area.

The catalog is selective in two senses. First, we have included those organizations that the authors believe are the most significant and have the greatest influence in contemporary policy making regarding science, technology and innovation. Second, we have excluded organizations that focus narrowly on biomedical, ICT, environment, energy, and national security matters involving science, technology and innovation.

Following the catalog, we provide additional information for a subset of the think tanks and organizations that, in the judgment of the authors, are especially influential in the public policy arena in Washington, DC. In the catalog, these organizations are indicated by a leading ★.

	Federal Government Entities	
★	Office of Science and Technology Policy	https://www.whitehouse.gov/administration/eop/ostp
★	National Science Board of the National Science Foundation	http://www.nsf.gov/nsb/
	National Economic Council	https://www.whitehouse.gov/administration/eop/nec
	Council of Economic Advisors	https://www.whitehouse.gov/administration/eop/cea
★	Congressional Research Service of the Library of Congress	https://www.loc.gov/crsinfo/
	Government Accountability Office	http://www.gao.gov/
	Federally Affiliated Entities	
★	President's Council of Advisors on Science and Technology	https://www.whitehouse.gov/administration/eop/ostp/pcast
★	Science and Technology Policy Institute	https://www.ida.org/stpi.php
★	Defense Science Board	http://www.acq.osd.mil/dsb/
	Defense Innovation Board	http://www.defense.gov/News/News-Releases/News-Release-View/Article/857710/secretary-carter-names-additional-members-of-defense-innovation-advisory-board

	Woodrow Wilson Int'l. Center for Scholars, Science, Technology and Innovation Program	https://www.wilsoncenter.org/program/science-and-technology-innovation-program
	Non-Profit Organizations	
★	American Association for the Advancement of Science, Center for Science, Policy and Society Program	https://www.aaas.org/program/center-science-policy-and-society-programs
★	Information Technology and Innovation Foundation	https://itif.org/
★	National Academy of Sciences/National Academy of Engineering/National Academy of Medicine	http://www.nationalacademies.org/
	American Academy of Arts and Sciences	https://www.amacad.org/
	American Enterprise Institute	www.aei.org
	Breakthrough Institute	http://thebreakthrough.org/
	Brookings Institution, Center for Technology Innovation	https://www.brookings.edu/center/center-for-technology-innovation/
	Cato Institute	www.cato.org
	Center for American Progress	https://www.americanprogress.org/
	Center for Policy on Emerging Technologies	http://www.c-pet.org/
	Center for Strategic and International Studies	www.csis.org
	Council on Competitiveness	www.compete.org
	Economic Policy Institute	http://www.epi.org/
	Federation of American Scientists	http://fas.org/
	Heritage Foundation	http://www.heritage.org/
	Kaufmann Foundation	www.kaufmann.org
	New America, Open Technology Institute	https://www.newamerica.org/oti/
	Potomac Institute for Policy Studies	http://www.potomacinstitute.org/
	RAND, Science, Technology and Policy Program	http://www.rand.org/jie/science-technology-policy.html
	Resources for the Future	www.rff.org
	RTI International	https://www.rti.org/
	SRI International, Center for Innovation Strategy and Policy	https://www.sri.com/about/organization/global-partnerships/cisp

	Technology Policy Institute	https://techpolicyinstitute.org/
	Profit-making Organizations	
	McKinsey Global Institute, Technology and Innovation	http://www.mckinsey.com/mgi/our-research/technology-and-innovation
	Academic Organizations	
★	Arizona State University, Institute for the Future of Innovation in Society	https://sfis.asu.edu/
★	MIT, Industrial Performance Center	http://ipc.mit.edu/
	Carnegie Mellon University, Dept. of Engineering and Public Policy	https://www.cmu.edu/epp/
	George Washington University, Center for International Science and Technology Policy	https://cistp.elliott.gwu.edu/
	Georgia Institute of Technology, School of Public Policy	http://www.spp.gatech.edu/

DETAILS OF KEY THINK TANKS AND RELATED ORGANIZATIONS

As noted before the table, we offer here a few details about a subset of the think tanks and related organizations that, in our judgment, that have the greatest influence in policy making for science, technology and innovation at the Federal level in Washington, DC. This is not to say that the organizations we chose not to discuss here do not make important contributions; rather, it is to say that the ones we have selected are engaged over a wide array of relevant issues on a sustained basis and engage substantial participation and attention by the relevant policy making communities.

OFFICE OF SCIENCE AND TECHNOLOGY POLICY

The Office of Science and Technology Policy (OSTP) is a unit of the Executive Office of the President of the United States tasked with advising the President and his senior officials about scientific and technical aspects of important public policy issues, including the funding and conduct of R&D and the adequacy of the scientific and engineering workforce. Its Director is also the Assistant to the President for Science and Technology.

OSTP issues studies and reports on specific topics of high priority to the President and the OSTP Director, reflecting broad interests throughout the Federal government and the nation. Some of these reports are attributed to the interagency National Science and Technology Council.

PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY

The President's Council of Advisors on Science and Technology (PCAST) is a high-level committee of members of the public distinguished by their accomplishments and leadership roles in industry, academia, government and elsewhere involving scientific and technical matters. It is co-chaired by one of its members and by the Director of OSTP.

At the request of the President, PCAST does studies and makes recommendations to the President about ways that science, technology and innovation can be brought to bear to address important national challenges in such areas as public health and safety, the environment, industrial technology and competitiveness, and so on. PCAST reports are often released in collaboration with senior White House officials, sometimes up to and including the President.

NATIONAL SCIENCE BOARD OF THE NATIONAL SCIENCE FOUNDATION

The National Science Board (NSB) is made up of sixteen distinguished citizens, appointed by the President with the advice and consent of the United States Senate. NSB has a dual role. One of its roles is to share with the Director of the National Science Foundation (NSF) the responsibility for administering the work of NSF. This role is unique in the Federal system; no other agency has an external board with real administrative responsibility of this type.

The second role of the NSB is to advise the President, the Congress, and the American people on the health of the scientific and technical enterprise of the United States and to recommend policies and options to strengthen that enterprise. From time to time, the NSB issues reports that advocate for significant improvements in how science and technology are supported and used in the United States.

In addition, the NSB has the formal responsibility for preparing the biannual report, *Science and Engineering Indicators*, that also serves as a compendium of statistics and analyses about a wide array of activities and issues in science, engineering, and innovation both in the United States and in other leading nations.[16] In this connection, the NSB is supported by the staff of NSF's National Center for Science and Engineering Statistics.

CONGRESSIONAL RESEARCH SERVICE OF THE LIBRARY OF CONGRESS

The Congressional Research Service (CRS) was discussed in the opening section of this report as an early example of a "think tank" located in government. CRS has served Congress for many

[16] See, for example, "Science and Engineering Indicators—2016" at: www.nsf.gov/statistics/2016/nsb20161/#/

decades by providing research and analysis services to the Members and committees of the United States Congress on a very wide range of issues—essentially on every significant issue in public policy that comes before the Congress for consideration.

CRS issues hundreds of reports annually. By law, the vast majority of those reports are not made public. However, despite the legal restriction on public dissemination, most of CRS' more general reports do find their way into the public arena. Reports on topics in science and technology policy related to national security, for example, can often be accessed via a Web site maintained by the Federation of American Scientists.[17] A broader set of CRS publications can be accessed at a site maintained by the University of North Texas.[18] It should be emphasized that it is not against the law to obtain, possess, or read unclassified CRS reports; the legal prohibition that exists only bars CRS from directly disseminating its reports to the public.

From the mid-1960s until the early 1990s, CRS had a Science Policy Research Division that focused heavily on R&D funding and on ways to mobilize science and technology for the economy, public health, and the environment. More recently, that work has been carried out in CRS's Resources, Science and Industry Division.

SCIENCE AND TECHNOLOGY POLICY INSTITUTE

The Science and Technology Policy Institute (STPI) was chartered by Congress, originally as the Critical Technologies Institute, to serve as a think tank devoted to the needs of the Office of Science and Technology Policy in the Executive Office of the President. STPI is a Federally Funded Research and Development Center operated by the Institute for Defense Analyses under an agreement with the National Science Foundation.

Under its charter, STPI may also do policy studies in science and technology for other agencies and departments of the Federal government, and it has used this authority aggressively to build a Federal clientele that extends well beyond OSTP, while always keeping OSTP as its primary client organization.

Many of STPI's studies are made public, eventually if not immediately. The original focus on identifying and analyzing so-called "critical technologies" has given way to a much broader agenda of policy studies and analyses.

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[17] https://www.fas.org/sgp/crs/

[18] http://digital.library.unt.edu/explore/collections/CRSR/browse/?q=%22science%20policy%22&t=dc_subject

DEFENSE SCIENCE BOARD

The Defense Science Board is a Federal Advisory Committee, first chartered sixty years ago, to "...provide independent advice and recommendations on matters relating to the Department of Defense's (DoD) scientific and technical enterprise..." to the senior civilian leadership of the Department of Defense, including the Secretary of Defense. While its formal remit is to advice on the DoD scientific and technical enterprise, the scope of that enterprise is so broad and touches the commercial marketplace in so many ways that the view of the Board often have important implications for civilian science and technology as well.

NATIONAL ACADEMY OF SCIENCES/NATIONAL ACADEMY OF ENGINEERING/ NATIONAL ACADEMY OF MEDICINE

The "National Academies," consisting of the National Academy of Sciences, the National Academy of Engineering, and the National Academy of Medicine, operate what is undoubtedly the largest enterprise devoted to strategic studies and analyses of science, technology and innovation, including its public policy aspects.[19]

The National Academies operate under a congressional charter first adopted in 1864, which also makes them one of the oldest, if not the oldest, American think tanks. In addition to advising government agencies and departments, the Academies also serve as the nation's foremost honorary societies, recognizing distinguished accomplishments by leading scientists, engineers, physicians and others. Committees of Academy members and other volunteer experts, assisted by well over one thousand staff members, conduct hundreds of studies annually at the request of government, and a much smaller number at their own initiative.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE: CENTER OF SCIENCE, POLICY, AND SOCIETY PROGRAMS

The AAAS is one of the world's largest scientific societies and perhaps the largest devoted to both interdisciplinary science and technology and encouraging scientists and engineers to work together to address the world's greatest social, economic, and environmental challenges. AAAS

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[19] For a recent TPI study of the role of the National Academies see, "The Roles of the U.S. National Academies in Influencing Federal S&T Initiatives." A report to NEDO by George R. Heaton, Jr., Christopher T. Hill, and Patrick H. Windham, December 2014. On-line at: http://www.technopoli.net/yahoo_site_admin1/assets/docs/National_Academies_and_ST_Initiatives.25281253.pdf

publishes a number of research journals, including *Science*. Its annual meetings in the United States draw thousands of scientists and engineers, students, policy makers, and journalists.

For many years, AAAS has played a leading role in hosting and guiding discussions of science, technology, innovation, and medical policy in Washington, DC, and in some state capitals as well. It is well established in STIP circles for leading an annual analysis of the place of science and engineering in the Budget of the United States. AAAS also coordinates and partially funds a large program for science and engineering fellows who are typically early-to-mid-career scientists and engineers who serve for one or two years in temporary advisory positions on congressional staffs or with Federal agencies.[20] In addition, AAAS organizes and hosts an annual Forum on Science and Technology Policy in Washington that convenes more than 500 leading analysts, academics, government officials, and others to hear presentations and to discuss current front -burner issues in science and technology policy, always including but never limited to discussions of the Federal R&D budget

INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION (ITIF)

ITIF is a private, non-profit research and analysis think tank that is focused on two broad topics: innovation policy and information policy, with the latter heavily focused on the digital future. ITIF publishes numerous reports and studies. In addition, it is quite active in hosting seminars and workshops for the policy community as well as for Congress and in other venues. Its leaders are active bloggers and frequently testify before Congress and contribute to panels and reports of other organizations. Many of their events are open to the public.

ARIZONA STATE UNIVERSITY, INSTITUTE FOR THE FUTURE OF INNOVATION IN SOCIETY

In the past decade or so, Arizona State University in Tempe, Arizona, has emerged as a leading academic institution in a variety of aspects of science, technology and innovation policy. It has recently established a new School for the Future of Innovation in Society. All of its work in science, technology and innovation policy can be characterized by an unusual focus on and sensitivity to the role of society in both shaping and being shaped by STI developments and policies. The focal point of its policy engagement is the new Institute for the Future of Innovation in Society, the research and engagement arm of the School. The Institute's Consortium for Science, Policy, and Outcomes has a presence in Washington, DC.

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[20] Many other scientific and technical societies now support such fellows, almost always in close coordination with the AAAS effort. In addition, AAAS has organized programs to support similar fellows in other agencies, such as the Environmental Protection Agency and the United States Department of State.

MIT, INDUSTRIAL PERFORMANCE CENTER

For nearly a century, MIT has played a very strong role in U.S. science, technology, and innovation policy. Its contributions and engagements at technical, leadership and policy levels remain unmatched by any other university in the United States. These contributions are also extremely diverse, involving many faculty, staff, and students, and this diversity makes it challenging to identify any single entity at MIT that addresses science, technology, and innovation policy. We highlight here MIT's Industrial Performance Center, which does comparative studies of the role of technology and management in affecting the performance of industrial sectors, but that is only one of many entities. MIT maintains an office in Washington, DC, that can serve as a point of entry into MIT's myriad contributors and that, itself, is an important contributor to national discussions on science and technology policy, innovation, manufacturing, and other topics.

CLOSING OBSERVATIONS

In what ways are the think tanks and other organizations discussed above particularly important and influential in overall science, technology, and innovation policy? Within the government, OSTP is of course very important, and PCAST periodically issues influential reports. The Science and Technology Policy Institute is important because it serves OSTP. The National Science Board helps shape basic research policy. In the defense technology community, the Defense Science Board is highly influential. Within Congress, CRS is very important. It is non-partisan and does not offer policy recommendations, but members of Congress and their staffs rely heavily on the analyses CRS prepares and on the broad specialized experience of senior CRS analysts

Outside of government, the National Academies are the largest, most important, and probably most influential STI policy think tanks. They have a formal charter to advise the Federal government that dates back to the 1860s, and they receive government contract funding to do most of their specific studies. However, they work diligently to remain independent of the policy and political interests of any particular Administration or congressional interest. In addition to issuing reports of their studies, they hold hundreds of meetings each year that bring experts, government officials, and interest group leaders together to explore issues and policy options.

In recent years, the Information Technology and Innovation Foundation (ITIF) has become an important "thought leader" on STI policy issues. While it focuses on information technology and acknowledges that it receives funding from firms in the IT industry, it also is one of the few organizations that also makes recommendations about general innovation policy. Each year it

also conducts many policy sessions, giving it an important role in Washington's conversations about STI policy.

A key point is that the influence of particular think tanks is not static, but changes depending on the importance of particular policy issues and other factors. For example, the Council on Competitiveness became very influential in the 1980s and 1990s when economic competitiveness was a central concern, while new organizations such as ITIF have grown in relative influence with the rise of information technology.

The best-known privately-funded think tanks in Washington, DC, play only limited roles in science, technology, and innovation policy. For example, the Brookings Institution has a "Center for Technology Innovation," but it focuses on policy issues related to applications of digital technologies and not on science, technology, and innovation more broadly. The American Enterprise Institute (AEI), another large and well-known think tank, has a "Center for Internet, Communications, and Technology Policy," but it also focuses more narrowly on information and communications technologies.[21]

Finally, as has often been observed, science and technology impinge on nearly every important issue facing national governments. Furthermore, the political system has looked to "innovation" as a means to address an ever-broadening array of problems. Thus, one can find many think tanks and related organizations that incorporate some aspects of science, technology and/or innovation into their studies, analyses, reports, and communications. These range from organizations focused on national security, public health, environment and energy, to those concerned with criminal justice, child rearing, and foreign affairs. As a result, the community of organizations in Washington, DC, that is concerned with science, technology and innovation policy is ever-evolving and its boundaries are ever-shifting as the needs and interests of policy makers and the public change.

[21] One problem today in Washington, DC, is that the information and telecommunications community has appropriated the word "technology" to mean only digital and information technologies. As a result, a number of organizations that have the word "technology" in their names in fact pay little or no attention to most other technologies. The Technology Policy Institute is an example of this phenomenon.

APPENDIX – ACCESSING THINK TANKS AND RELATED ORGANIZATIONS

With some exceptions, think tanks and related policy analysis and policy influencing organizations that are in Washington, DC, or that contribute significantly to national policy debates on science, technology and innovation thrive on public attention to their studies and reports and on public participation in their open seminars, workshops and other events. They all seek to build networks of influential people who will attend, participate, read, comment and general engage with them.

Turn-over of staff in many but not all think tanks is high, so there are always new faces among participants in think tank activities. Generally, everyone who is at all qualified is welcome to attend their events. Representatives of foreign embassies and overseas R&D organizations are almost always welcome and, in fact, are often encouraged to make themselves part of the networks associated with these communities. Attending public events is almost always a good way to make contacts in such organizations. It is also usually quite possible to arrange for personal meetings with their leadership and analysts to build mutual understanding and networks.

A few organizations are much less open than most, generally reflecting a close connection with or responsibility to sponsoring organizations. Examples include the Congressional Research Service, which works only for the Congress, and the Science and Technology Policy Institute, which has a privileged relationship with OSTP. Security classification can occasionally limit access, as can requirements to protect trade secrets when data used by think tanks have been provided by commercial interests.