National Preferences in Publicly-Supported R&D Programs

A Report to NEDO

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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). Its authors, working together as the firm of Technology Policy International (TPI), have undertaken the study as independent consultants, although it should be noted that each has other professional affiliations and activities (see "About the Authors"). The opinions expressed in this report do not necessarily reflect the views of NEDO or the institutions with which the authors are affiliated.

Minor editorial changes and updates to an author's affiliation were made to this report in March 2011. The pagination is altered somewhat from the original owing to the use of different versions of a word processing program, but no substantive changes were made to the text.

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1. INTRODUCTION TO THIS REPORT

In the fall of 2009, the Washington, D.C. office of NEDO commissioned TPI to undertake an analysis of "National Preferences in Publicly-Supported R&D Programs." The inquiry focused on whether, and on what terms, "foreign" firms participate in R&D programs supported with public funds in the U.S., Europe and Japan.

The need for a better understanding of national preferences in public R&D is more pressing than ever. Little work has been done on this question for about ten years. Meanwhile, the R&D community has become ever more global, and the notion of a "foreign" firm ever more elusive as the degree of foreign investment increases in all the countries studied. Public R&D programs, much like the private sector, understand the value of transnational participation. -- NEDO's recent New Mexico partnership provides a notable example.[1] Nevertheless, public programs in every country must carefully consider their national interest, as expressed in a diverse mix of law and practice.

The analysis of the report is to divide the question into four main parts. It begins with an examination, in Chapter 2, of some of the concepts, history and assumptions that underlie national preferences in R&D programs. Chapter 3 looks at the history of national preference policies in the U.S. in several major R&D programs. Chapter 4 addresses the European experience. In Chapter 5, we conclude by considering some of the choices and trade-offs that are involved in establishing sensible policies for foreign participation in public R&D.

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[1] In March 2010, NEDO entered into a four-year R&D project in New Mexico to demonstrate smart grid technology. The participants include NEDO, 31 Japanese companies, state and local government agencies in New Mexico, Los Alamos National Laboratory, Sandia National Laboratories, and several U.S. companies. See Roger Snodgrass, "Smart grid effort: Japan sponsors experimental energy research," Los Alamos Monitor, March 6, 2010, http://www.lcni5.com/cgi-bin/c2.cgi?075+article+News+20100306141142075075004. See also: See "Japan Signs Smart Grid Agreement with New Mexico," New Mexico Business Journal, March 5, 2010. http://albuquerque.bizjournals.com/albuquerque/stories/2010/03/01/daily5

2. NATIONAL PREFERENCES: A TRANSFORMED POLICY CONTEXT

2.1 Reasons for (and Against) National Preferences in Publicly Supported R&D

It has long been common practice for countries to adopt some form of "national preference" -- for domestic participants over foreign -- when public funds are expended to support R&D. At least four different kinds of "reasons" underlie this practice, although none can be said to amount to a theoretical "rationale."

First, public policy-makers at the national level tend to see their countries as being in competition with others, economically and technologically, and thus, the desire to gain competitive advantage is a primary motivation behind national preferences. When a country perceives itself to be "behind" or "challenged" in a particular industrial or technological arena, publicly supported R&D programs targeted to that sector are often mounted to meet the competition.[2] And it becomes natural to exclude the external competitors from any such "catch-up" effort. When a country perceives itself to be "ahead," exclusion of foreign participants in publicly supported R&D projects can be a means of retaining that perceived lead.

Sometimes, this competitive dynamic, coupled with reasons of diplomacy, can become quite complicated. For example, when Japan put forward the IMS Program (Intelligent Manufacturing Systems) program around 1990, it seemed both to perceive itself to be in a position of technological strength in

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[2] A good example of this in the U.S. is the Sematech program, discussed in the next chapter. For a discussion of how cooperative R&D was directed to this end in Japan, see George R. Heaton, Jr., "The Truth about Japanese Cooperative R&D," *Issues in Science and Technology*, Fall 1988.

manufacturing systems and as having accumulated a deficit in contributions to international science and technology. Thus, it proposed to fund R&D in both foreign and domestic firms. Many in the U.S., perceiving the U.S. to be ahead of Japan in manufacturing technology, characterized the Japanese IMS proposal as a way to gain easy access to American technology. Thus, the project ended up with national funding of national firms.[3]

A second reason for national preferences is concern for "taxpayer equity." The argument in this case rests on the fact that public funding for R&D projects derives from tax revenues, and that it is therefore only "fair" that those who pay in – the taxpayers – should also be the ones who receive the funds disbursed within the R&D project. Since foreign entities are not necessarily domestic taxpayers, so the theory goes, they should not qualify for such benefits.

The third, simplest reason for national preferences is politics: it is hard to persuade politicians that they should vote for or fund a program in which government largess might be distributed to foreign entities that do not represent any domestic constituency. In contrast, it is relatively easy to get a politician to vote in favor of programmatic restrictions that appear to preserve public largess for domestic constituents.

Fourth, preference is typically, but not always, given to domestic R&D performers when the research is focused on national security matters, such as weapons systems; command, control, communications, and information; defensive systems; and the like. Since U.S. national security strategy has long been premised on technological superiority over any conceivable foe, ensuring that state-of-the-art technologies do not fall into the hands of potential adversaries has been a powerful rationale for favoring domestic performers

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[3] Heaton, George R., Jr., Manufacturing Forum of the National Academy of Engineering and National Academy of Sciences, *International R&D Cooperation: Lessons from the Intelligent Manufacturing Systems Proposal*, Washington D.C., June 1991.

whose loyalties are more likely to be with the U.S. and whose conduct can be more easily monitored. However, since many national security technologies often have civilian applications as well (so-called "dual-use" technologies), the national security rationale can easily spill over into policies affecting what might be otherwise appear to be civilian R&D programs.

Despite the strength of the above arguments in favor of domestic preferences, they are by no means always persuasive, or without counterarguments. Indeed, competitive concerns may often present a good reason to let foreign entities in to public R&D programs, rather than to exclude them, to the extent that they bring valuable expertise. This is obviously true when a country perceives itself to be "behind." Similarly, the natural goal of any R&D program to be excellent and at the cutting edge implies that the best participants from around the world should be invited in, irrespective of national origin.

Equity and diplomatic considerations also cut in more than one direction. If a country wants its companies and researchers to be included in major international projects or projects sponsored by other countries, it is not a good strategy to be exclusive at home. Lastly, the principle of "national treatment" in international law and diplomacy argues against denying "reciprocal" privileges in R&D programs to other countries that meaningfully open their doors.

2.2 The Role of International Trade Rules

It is important to note that international trade rules do *not* prohibit the United States or any other country from using its domestic R&D programs to benefit its own companies and economy. As a result, the United States has great freedom to design its rules as it wishes.

First, there is no rule under World Trade Organization (WTO) trade law that requires member governments to open up their R&D programs to foreign companies or other foreign entities. There is an Agreement on Government Procurement that says WTO member governments that have signed this agreement should not discriminate against foreign companies when making government purchases.[4] But this agreement does not apply to "purchases" of R&D.

Second, there is no rule under WTO trade law that prohibits member governments from using typical R&D programs to help their companies. There is a WTO Agreement on Subsidies and Countervailing Measures ("SCM Agreement")[5] that does prohibit certain types of financial contributions to domestic companies, because those contributions are seen as unfair trade assistance. The agreement bans certain types of grants, loans, equity infusions, loan guarantees, and other aid. But when WTO members last debated the SCM Agreement, during the Uruguay Round of the 1990s, the United States sought and obtained provisions that allow cost-shared public-private R&D programs and other R&D assistance.[6]

Even though WTO rules do not require that the U.S. and other WTO members open up their domestic R&D programs to foreign companies, at times

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[4] For a summary of this agreement, see "Overview of the Agreement on Government Procurement," http://www.wto.org/english/tratop_e/gproc_e/gpa_overview_e.htm.

[5] For a summary of the subsidies agreement, see "Agreement on Subsidies and Countervailing Measures ("SCM Agreement"), http://www.wto.org/english/tratop_e/scm_e/subs_e.htm.

[6] For a summary of the U.S. position and the resulting changes in the SCM Agreement, see "Statement of the Honorable John H. Gibbons, Director, Office of Science and Technology Policy, before the Subcommittee on Technology, Environment, and Aviation, Committee on Science, Technology, and Space, United States House of Representatives, April 20, 1994," http://clinton1.nara.gov/White_House/EOP/OSTP/other/gatttest.html. It is important to note that some government technology assistance may still be improper under the SCM. Nations may object to another government's R&D subsidies or other assistance if they feel that this assistance has distorted trade or caused economic injury.

trade officials in the U.S. Government and representatives of foreign companies with operations in America have tried to persuade Congress to apply the principle of "national treatment" ("non-discrimination") to U.S. R&D programs. This would mean that foreign companies, or foreign companies with operations within the United States, would have the same eligibility as American companies when applying for federal R&D money. But while Congress has occasionally accepted this argument, it has more often rejected it.[7]

2.3 Forms of National Preference

National preferences in publicly supported R&D programs may be focused on either individuals or corporate entities. They take only a few basic forms.

In the case of individuals, citizenship provides an easy and generally conclusive criterion on which to base a national preference policy. Nevertheless, the U.S. and many other countries also recognize the category of "permanent resident," and generally treat such individuals as citizens even though they are not.

In the case of corporations, the question of "citizenship" is a much more malleable concept. In the U.S., all corporations are incorporated by individual states, not by the Federal government. Therefore, for purposes of state law, any corporation whose charter comes from another state is considered "foreign," irrespective of whether that state is another in the U.S. or another country. The additional fact that corporations are routinely incorporated in various jurisdictions throughout the world makes the site of incorporation only the

[7] During the 1991-92 debate in Congress over foreign eligibility rules for the Commerce Department's Advanced Technology Program (ATP), several trade lawyers argued that the principle of national treatment should apply to the ATP. Congress did not accept that argument.

beginning of the analysis.[8] All of the U.S. Federal laws pertaining to national preference recognize this, and therefore impose criteria that go beyond the apparent legal "home" of the corporation.

Another way that national preferences can be expressed is through conditions of ownership or management structure. Some policies speak in terms of "ownership by U.S. citizens;" others, "majority ownership by U.S. citizens or resident aliens." While both of these approaches are clear on their face, neither can very effectively take account of the fact that corporate ownership can change frequently and dramatically, and that sometimes the ultimate owners of a corporation's share may not be fully known, particularly if the shares are held by subsidiary corporations, corporate shells or trusts. In other cases, there are requirements that the managers of a corporation be citizens of the country granting special preferences.[9]

The final method commonly used to express national preferences is to impose activity restrictions on participants in particular programs. For example, a requirement of "substantial" U.S. manufacture is imposed on licensees of Federally supported inventions under the Bayh-Dole and the Small Business Innovation Research Act (SBIR) [10] Other laws speak in terms of contributions to U.S. employment or the usage of funds only in the U.S. As discussed later, it has proven increasingly difficult to implement such requirements because of globalization and the disaggregation of manufacturing supply chains.

2.4 Static Policies; Transformed Policy Context

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[8] In international law, there is a large and complicated body of jurisprudence on the issue of corporate "siège social" and the "substantiality" of its contacts with different jurisdictions as means to determine corporate nationality.

[9] One of the most complicated examples of this in U.S. law ("the Jones Act") is for boats that fish or engage in the "coast-wise trade." The majority of the number of directors necessary to make a voting quorum must be U.S. citizens.

[10] See discussion below in Section 3.

Many of the national preference policies enacted in the U.S. were put in place during the 1980s – as were many new technology policies of various kinds.[11] Much of the reason for the sweeping policy changes undertaken during the 1980s was the perception that the U.S. was in a "competitiveness crisis." The fact that American firms were losing ground in world markets urged policy makers to construct a new framework, one that would enhance the national economic interest. Japan, above all, represented the major competitive challenge for the U.S. Indeed some of the new technology policies of the era were put in place specifically in response to Japanese competitive challenges, and others were consciously imitative of technology policies pioneered by Japan that had appeared to work to its competitive advantage. [12]

The national preference policies put in place for the most part during the 1980s have seen little or no change since then. About 10 years after their enactment, a series of studies sought to take stock of them. These included the following works:

- *Foreign Eligibility for U.S. Technology Funding*, U.S. Congress, Office of Technology Assessment Washington, D.C. September 1995 (OTA-BP-ITC-154)
- *Foreign Participation in U.S. Research and Development: Asset or Liability?*, Proctor Reid and Alan Schriesheim, Eds., Committee on Foreign Participation in U.S. Research and Development, National Academy of Engineering, Washington, D.C., 1996
- *International Friction and Cooperation in High-Technology Development and Trade: Papers and Proceedings,* Charles W. Wessner, Editor; National Research Council, Washington, D.C. 1997. ISBN: 0-309-52441-5.

As valuable and of high quality as these studies were, it is safe to say that they

[11] See George R. Heaton, Jr., Christopher T. Hill, and Patrick Windham, *Policy Innovation: The Initiation and Formulation of Science and Technology Policies in the U.S. During the 1980s*, a Report to JETRO-NY and NEDO-DC, Technology Policy International, March 2000.

[12] Changes in U.S. antitrust laws to encourage cooperative R&D industry, as well as the Advanced Technology Program – discussed in *Policy Innovation*, above, and in Section 3, are leading examples of this.

continued to reflect the mindset of the time in which the national preference policies were put in place. While the studies certainly enhanced the understanding of the policy framework, they neither recommended nor produced any change in it.

In the 20 or so years since the enactment of U.S. national preference policies, much has changed in the external environment. Perhaps the most salient fact is the ever-increasing internationalization of the global R&D community. The figure below presents a schematic of the flows of foreign R&D into the U.S. and outflows of U.S. multinationals' R&D to other regions, for the year 2006 (the latest for which data are available.[13] Since this figure only presents a snapshot in time, it is also important to note the degree of increase over time. If one looks at the increase in foreign companies' R&D expenditures in the U.S. during the years between 1997 and 2006, one sees the following rates:

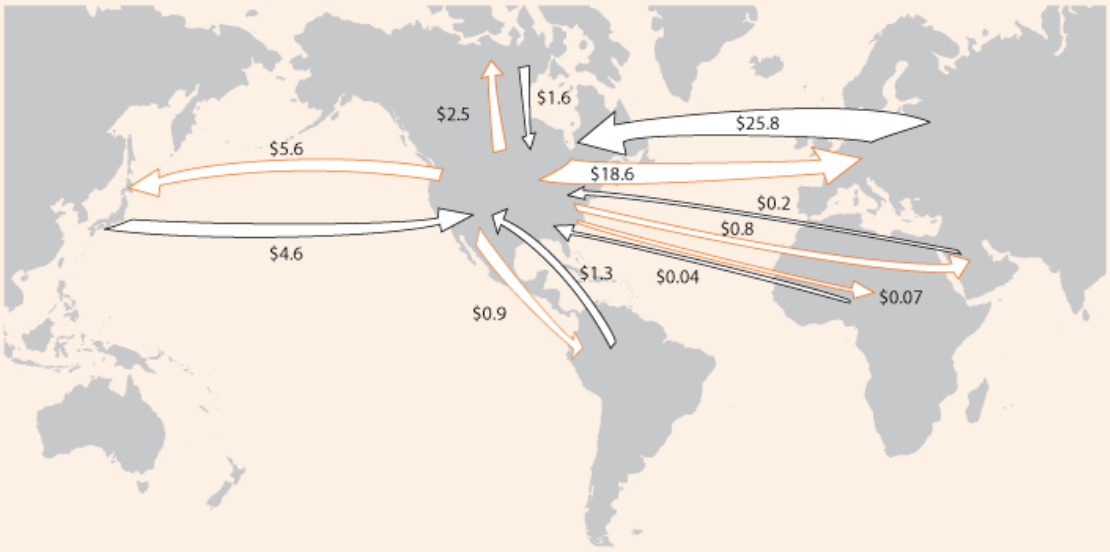
- European R&D in the U.S. – 98% increase
- Japanese R&D in the U.S. – 96% increase

The following figure provides additional information on these recent flows of R&D funds.[14]

[13] National Science Board, *Science and Engineering Indicators: 2010*, Figure 4-20. NSF, Washington, D.C., 2010.
[14] Appendix Table 4-32, *Science and Engineering Indicators 2010*, cited above.

Figure 4-20
R&D performed by U.S. affiliates of foreign companies in United States, by investing region, and performed by foreign affiliates of U.S. multinational corporations, by host region: 2006

(Billions of current U.S. dollars)



NOTES: Preliminary estimates.

SOURCES: Bureau of Economic Analysis, Survey of Foreign Direct Investment in the United States (annual series); and Survey of U.S. Direct Investment Abroad (annual series). See appendix tables 4-32 and 4-34.

Science and Engineering Indicators 2010

It is also instructive to consider the degree to which R&D inside different countries has become internationalized. Measured by the percentage of internal R&D expenditures accounted for by majority-owned affiliates of foreign companies, the following ranking appears:

- U.K. – approximately 40%
- Germany – approximately 28%
- France – approximately 25%
- U.S. – approximately 15%
- Japan – approximately 5%[15]

Although R&D is the focus of the discussion here, it is important to note that the production of goods and services has also become profoundly internationalized, as a result of outsourcing and a wide variety of corporate

[15] OECD, *Science, Technology and Industry Outlook, 2005*, Paris, 2005, ISBN 978-92-64-04991-8.

arrangements. This leads to a situation in which it is often difficult to attribute a national origin to products, services or corporations with any credibility.[16] In such circumstances, the terms "foreign" and "domestic" lose much of their meaning.

Putting together the history of U.S. national preference policies, with data such as the above, the conclusion to be drawn is that while the policy context has changed, the policies themselves have remained static. The implication of this juxtaposition will be considered throughout the remainder of this report and, in particular, in its final chapter.

[16] J. Zysman, N. Nielsen and D. Breznitz, "Building on the Past, Imagining the Future: Competency Based Growth Strategies in a Global Digital Age," BRIE Working Paper #181, October 2007.

3. NATIONAL PREFERENCES FOR PUBLICLY-SUPPORTED R&D PROGRAMS IN THE UNITED STATES

3.1 Chapter Introduction

This section of the report examines United States Government policies regarding national preferences in publicly-supported R&D programs.

There are at least three types of U.S. R&D programs, each serving a different purpose and each generally having different rules regarding participation by foreign companies and foreign government laboratories:

- R&D programs to help create technologies to meet the government's own needs. So-called "acquisition agencies," such as the Department of Defense (DOD), fund these R&D programs. Their purpose is to help create advanced technologies that the agencies can then acquire and use in their own operations.
- R&D programs to build new technological capabilities that will help the economy. These include programs at the Department of Commerce (DOC) and Department of Energy (DOE), as well as the Small Business Innovation Research Program (SBIR) and technology licensing activities under the Bayh-Dole Act.
- Basic research programs whose purpose is to advance knowledge. Two important basic research agencies are the National Science Foundation (NSF) and the National Institutes of Health (NIH). NASA and the Department of Energy (DOE) also have basic research programs.

In general, acquisition agencies focus on funding the best technology ideas they can find, regardless of where those ideas come from. They tend to welcome foreign entities, as long as national security is preserved. Programs that aim to build U.S. technological capacity for economic reasons generally either support Americans only or have special rules to ensure that funds going to foreign-

controlled companies and laboratories still benefit the U.S. economy. Basic research agencies generally prefer to fund U.S. researchers only, although NIH funds some researchers in developing countries.

The rest of this section provides additional details about these policies regarding national preferences. It begins with an examination of the principal acquisition agency in the U.S. Government, the Department of Defense.

3.2 Rules at America's Most Important Acquisition Agency: the Department of Defense

The Department of Defense has a very large R&D program – $82.6 billion in federal fiscal year (FY) 2010. Most of that amount – $68.7 billion in FY 2010 – goes for the development of new weapon systems, and some foreign defense firms participate in that work. The remaining $14.8 billion goes to more fundamental work in science and technology.

In this fundamental area, the DOD actually welcomes the involvement of foreign companies in unclassified ("non-secret") projects. The reason appears to be that the DOD wants the best technology and the best technology ideas, regardless of where they come from.

The Defense Advanced Research Projects Agency (DARPA), the U.S. Government's most important agency for the development of new technologies, illustrates this openness. A typical DARPA request for proposals (called a "broad agency announcement," or BAA) for unclassified R&D contains the following language:

> *Responders may be foreign firms or may team with foreign firms as long as the firm meets the criteria in this BAA and the Government is otherwise*

> *permitted to conduct business with the firm. However, only unclassified proposals will be considered from foreign sources, or where any proposed teaming arrangement involves a foreign source. Proposers may include foreign personnel as part of their proposed resources as long as these personnel qualify technically, the proposed effort is unclassified, such foreign personnel sign any and all appropriate non-disclosure agreements prior to participating in the research effort, and proposers obtain all relevant export licenses prior to disclosing any controlled technology or information to such foreign personnel.*[17]

So DARPA does allow and even encourage foreign participation in its unclassified research programs. However, the paragraph cited above does mention several important requirements. In particular, foreign proposers must sign non-disclosure agreements[18] and obtain all relevant export licenses, as must domestic firms if they anticipate employing persons who are not citizens or permanent resident aliens on the project.[19]

Other R&D agencies within the Defense Department have similar policies regarding eligibility in unclassified projects. This statement comes from a typical BAA from the Army Research Office:

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[17] Microsystems Technology Office-Wide BAA 07-18, Defense Advanced Research Projects Agency, January 2007, http://www.darpa.mil/mto/solicitations/baa07-18/pdf/amendment.pdf, page 6.

[18] The following is a good description of what Americans mean by a non-disclosure agreement: "A non-disclosure agreement (NDA), also known as a confidentiality agreement, confidential disclosure agreement (CDA), proprietary information agreement (PIA), or secrecy agreement, is a legal contract between at least two parties that outlines confidential material, knowledge, or information that the parties wish to share with one another for certain purposes, but wish to restrict access to by third parties. It is a contract through which the parties agree not to disclose information covered by the agreement. An NDA creates a confidential relationship between the parties to protect any type of confidential and proprietary information or trade secrets. As such, an NDA protects non-public business information." This description comes from "Non-disclosure agreement," *Wikipedia*, http://en.wikipedia.org/wiki/Nondisclosure_agreement.

[19] The U.S. Government restricts the export of equipment and information that is of potential military value to certain countries. One set of export controls applies to defense technologies and information; these controls operate under the International Traffic in Arms Regulations (ITAR), administered by the Department of State. So-called "dual-use technologies" that have both civilian and defense applications fall under the control of the Export Administration Act and associated Export Administration Regulations, enforced by the Department of Commerce. Under both laws, companies and individuals must obtain export licenses before exporting certain equipment or sharing certain knowledge with foreign citizens, even if those citizens are working in the United States.

> *Proposals may be submitted by degree-granting universities (foreign and domestic), nonprofit organizations, or industrial concerns (large and small businesses)….*
>
> *The Contractor shall comply with all U.S. export control laws and regulations that may apply in the course of the research, including the International Traffic in Arms Regulations (ITAR) … and the Export Administration Regulations (EAR) … in the performance of this contract….*
>
> *The Contractor shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this contract, including instances where the work is to be performed on-site at any Government installation (whether in or outside the United States), where the foreign person will have access to export-controlled technologies, including technical data or software.*[20]

TPI has not been able to find any data on how many unclassified R&D projects at DARPA or in other R&D units of the DOD include foreign firms or individuals. However, the DOD does clearly welcome good proposals from foreign firms or from American-led teams that include foreign firms. But equally clearly, export control regulations can be a major impediment to involving foreign firms (or even foreign individuals) in publicly-supported R&D projects in the United States.

3.3 Agencies, Programs, and Other Activities that Promote Economically Valuable Technologies

The rules for U.S. programs that promote economically important technologies are often quite different from those at DOD. Many of these programs do have preferences for U.S. companies or attach particular conditions regarding the eligibility of foreign companies. The reasons are (1) that Congress

[20] Development of Quantum Computing Technology, U.S. Army Research Office Broad Agency Announcement W911NF-10-R-0007, April 2010, http://www.arl.army.mil/www/DownloadedInternetPages/CurrentPages/DoingBusinesswithARL/research/QCTBAA2010%20Final.pdf, pages 4 and 13.

wants to make sure that these programs benefit the domestic U.S. economy and (2) it believes that such rules will help ensure that they do.

3.3.1 Types of U.S. Rules for Economically Important R&D

Congress has sometimes written rules that either provide preferences for American companies or place limitations on the eligibility of foreign companies to apply for federal R&D funds. These requirements vary from program to program, and there is no overall set of foreign eligibility rules for federal R&D programs.

In general, there are four main types of U.S. rules, each designed to help the United States capture the economic benefits from these taxpayer-supported technology programs:

- Some rules treat U.S. and foreign companies equally but require all companies, U.S. or foreign, to agree to manufacture resulting products largely within the United States.
- Other rules limit the R&D program to just companies owned by U.S. citizens or residents.
- A third approach allows foreign companies to apply to U.S. programs, but only if the home governments of these companies offer similar R&D opportunities to U.S. firm and meet other conditions. This is a type of "reciprocity requirement."
- The fourth approach allows joint projects but generally requires that each R&D participant receive funding from his or her own government.

The U.S. Government uses a combination of these approaches, as can be seen in the following discussion of specific U.S. R&D programs.

3.3.2 Technology Licensing Under the Bayh-Dole Act

One U.S. R&D program that has rules regarding national preferences and foreign participation is the technology licensing process under the Bayh-Dole Act

of 1980.[21] This law uses the first of the four approaches identified above, allowing exclusive licenses of inventions resulting from federal R&D funds to be licensed only to persons who agree to manufacture resulting products substantially in the U.S. This requirement is set forth in section 204 of the law, entitled "Preference for United States industry:"

> *Notwithstanding any other provision of this chapter, no small business firm or nonprofit organization which receives title to any subject invention and no assignee of any such small business firm or nonprofit organization shall grant to any person the exclusive right to use or sell any subject invention in the United States unless such person agrees that any products embodying the subject invention or produced through the use of the subject invention will be manufactured substantially in the United States. However, in individual cases, the requirement for such an agreement may be waived by the Federal agency under whose funding agreement the invention was made upon a showing by the small business firm, nonprofit organization, or assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible.*

The Bayh-Dole Act directs that non-profit organizations (especially universities) and small businesses can hold legal title to inventions that they develop with federal funds. Moreover, a later executive order by President Reagan directed federal agencies to transfer rights to all R&D performers, including large companies, where the transfer was not otherwise prohibited by law.

In some cases, though, the federal government retains ownership of inventions developed with federal funds. For these cases, section 209 of the Bayh-Dole sets forth rules for when a federal agency owns and licenses such an

[21] The Bayh-Dole Act is formally called the University and Small Business Patent Procedures Act, a part of the larger Patent and Trademark Amendments of 1980 (Public Law 96-517).

invention. The requirements here are similar to section 204, with the addition of a preference for small business:

> *(b) Manufacture in United States.— A Federal agency shall normally grant a license under section 207 (a)(2) to use or sell any federally owned invention in the United States only to a licensee who agrees that any products embodying the invention or produced through the use of the invention will be manufactured substantially in the United States.*
>
> *(c) Small Business.— First preference for the granting of any exclusive or partially exclusive licenses under section 207 (a)(2) shall be given to small business firms having equal or greater likelihood as other applicants to bring the invention to practical application within a reasonable time.*

3.3.3 The Small Business Innovation Research Program

In 1982, Congress passed the Small Business Innovation Development Act (Public Law 97-219). Congress has extended and modified the act several times since 1982, and the current version requires that most federal R&D agencies set aside 2.5 percent of their extramural R&D funds (funds that go to outside contractors) for small businesses. Congress has also created a Small Business Technology Transfer (STTR) Program that supports the transfer of university research to small firms.

SBIR and STTR take the second of the four approaches listed above, limiting the program to U.S. citizens and permanent residents. The following statement from a NASA Web site summarizes this rule:

> *To be eligible for either the SBIR or STTR programs, a small business must be independently owned and operated in the United States by U.S. citizens or permanent resident aliens. It must be organized for profit. Including any affiliates, the company can be the employer of no more than 500 people.*[22]

[22] "SBIR/STTR Program Information," http://sbir.gsfc.nasa.gov/SBIR/pmginfo1.htm#pmginfo4.

3.3.4 The Department of Commerce's Technology Innovation Program

The Technology Innovation Program (TIP) is the successor to the earlier Advanced Technology Program (ATP),[23] and TIP has the same basic rules as the ATP. These rules are a combination of the first and third approaches listed above – a combination of domestic manufacturing and reciprocity by foreign governments.

The ATP foreign eligibility rules were not contained in the original 1988 legislation that created the ATP but rather in a 1992 follow-on law, the American Technology Preeminence Act (Public Law 102-245). When Congress created TIP in 2007, it used similar legislative language regarding the eligibility of companies based in other countries:

> *'(1) the term 'eligible company' means a small-sized or medium-sized business that is incorporated in the United States and does a majority of its business in the United States, and that either –*
>
> *'(A) is majority owned by citizens of the United States; or*
>
> *'(B) is owned by a parent company incorporated in another country and the Director [of NIST] finds that –*
>
> *(i) the company's participation in the Technology Innovation Program would be in the economic interest of the United States, as evidenced by--*
>
> *`(I) investments in the United States in research and manufacturing;*
>
> *`(II) significant contributions to employment in the United States; and*
>
> *`(III) agreement with respect to any technology arising from assistance provided under this section to promote the manufacture within the United States of products resulting from that technology; and*
>
> *`(ii) the company is incorporated in a country which--*

[23] Congress authorized the ATP in the Omnibus Trade and Competitiveness Act of 1988 (Public Law 100-418), and the program received its first funding in 1990. Congress repealed the ATP authorization and replaced it with the TIP in the America COMPETES Act of 2007 (Public Law 110-69).

> *`(I) affords to United States-owned companies opportunities, comparable to those afforded to any other company, to participate in any joint venture similar to those receiving funding under this section;*
> *`(II) affords to United States-owned companies local investment opportunities comparable to those afforded any other company; and*
> *`(III) affords adequate and effective protection for intellectual property rights of United States-owned companies;'*[24]

The origins of the ATP rules lie in a proposal that a coalition of U.S. and European television manufacturers brought to U.S. Senate staff in 1991. These companies argued that the ATP should only support companies that manufactured in the U.S. and, in the case of foreign-owned companies, came from countries whose governments allowed U.S. firms to apply for their publicly supported R&D programs.

Congress considered this proposal in the early 1990s, during a time of intense high-tech competition with Japan and Germany. The fact that technology flows were becoming more global helps explain the reciprocity requirements in the ATP rules: it was good to require domestic U.S. manufacturing, but the technology funded by American taxpayers could also easily flow to other countries. As a result, Congress was receptive to a requirement that if a company wanted to apply to the ATP, then its home government should protect intellectual property and offer equivalent opportunities to U.S. companies. Congress did not want to subsidize America's competitors.

It is possible, of course, that these rules would prevent some highly technically qualified companies from applying to the ATP (and now TIP). But

[24] America COMPETES Act of 2007 (Public Law 110-69), section 3012.

Congress wanted rules that the American public would see as in the interests of the United States.

The Department of Commerce apparently makes decisions about eligibility on a case-by-case basis, when a company seeks to apply to the program. TPI cannot find any published information from DOC on which countries meet the ATP/TIP requirements or how many foreign-owned companies from qualified countries have actually applied for or received ATP/TIP awards over the years.

3.3.5 Technology Programs at the Department of Energy

The U.S. Department of Energy (DOE) is a large organization with multiple missions and different types of R&D programs. The National Nuclear Security Administration (NNSA) within DOE is primarily an acquisition agency, with R&D focused on nuclear weapons activities. The Office of Science is primarily a basic research unit. The section of the paper focuses on DOE's civilian energy technology development activities, which include R&D programs to help advance economically important areas such as energy efficiency, renewable energy, fossil energy, and civilian nuclear power.[25]

Most of the energy technology programs in the Department of Energy must follow eligibility rules set forth in the Energy Policy Act of 1992. Congress amended the Energy Policy Act in 2005, but left most of the eligibility requirements intact (although the eligibility requirements do not apply for all

[25] In addition to DOE programs where companies apply directly for federal R&D support, DOE also operates formal bilateral and multilateral R&D projects with other governments, and companies often participate in these collaborative projects. Examples of international collaborations include the Large Hadron Collider (LHC) and the International Thermonuclear Experimental Reactor (ITER). This paper does not discuss these international collaborations, since they are different from the R&D programs run by individual governments.

programs).[26] These requirements are expanded on in the Code of Federal Regulations.[27] The basic policy is similar to that for the ATP and TIP programs:

> *A company shall be eligible to receive an award of financial assistance under a covered program only if DOE finds that—*
>
> *(a) Consistent with §600.503, the company's participation in a covered program would be in the economic interest of the United States; and*
>
> *(b) The company is either—*
>
> *(1) A United States-owned company; or*
>
> *(2) Incorporated or organized under the laws of any State and has a parent company which is incorporated or organized under the laws of a country which—*
>
> *(i) Affords to the United States-owned companies opportunities, comparable to those afforded to any other company, to participate in any joint venture similar to those authorized under the Act;*
>
> *(ii) Affords to United States-owned companies local investment opportunities comparable to those afforded to any other company; and*
>
> *(iii) Affords adequate and effective protection for the intellectual property rights of United States-owned companies.*

This requires that all companies, both U.S. and foreign, demonstrate that their participation in the program is in the U.S. economic interest. It also says that foreign-owned companies can only participate if the parent company is based in a country that offers reciprocal opportunities to U.S. companies and has adequate intellectual property protection.

In determining whether a company's participation is in the economic interest of the United States, DOE can consider a variety of factors, such as employment, R&D, manufacturing, and procurement activities in the United States.

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[26] Department of Energy, Office of Procurement and Assistance Policy, *Guide to Financial Assistance*, Updated June 2008.
[27] 10 Code of Federal Regulations 600, Subpart F.

Different funding announcements may implement the economic interest requirements in different ways. For example, a recent clean coal R&D project requires that 75% of the direct labor cost on the project be spent in the United States, unless the awardee can explain why a lower percentage is in the U.S. economic interest. [28]

DOE has a particular process for determining the policies of other governments. The language in the Code of Federal Regulations is:

> *In making the determination under §600.502(b)(2), DOE may—*
> *(a) consider information on the relevant international and domestic law obligations of the country of incorporation of the parent company of an applicant;*
> *(b) consider information relating to the policies and practices of the country of incorporation of the parent company of an applicant with respect to:*
>
> > *(1) The eligibility criteria for, and the experience of United States-owned company participation in, energy related research and development programs;*
> > *(2) Local investment opportunities afforded to United States-owned companies; and*
> > *(3) Protection of intellectual property rights of United States-owned companies;*
>
> *(c) Seek and consider advice from other federal agencies, as appropriate; and*
> *(d) Consider any publicly available information in addition to the information provided by the applicant.*

This process gives the Department a great deal of flexibility in deciding how it makes this decision. The program office would make the initial determination, with input from the general counsel. If there was a dispute, the Under Secretary or perhaps even the Secretary of Energy would make the final decision.

[28] U. S. Department of Energy, National Energy Technology Laboratory, Funding Opportunity Number: DE-FOA0000131, "Bench-Scale and Slipstream Development and Testing of Post-Combustion Carbon Dioxide Capture and Separation Technology for Application to Existing Coal-Fired Power Plants."

In practice, many foreign-owned firms do fully participate in DOE energy programs. For example, a recently announced program to increase the fuel efficiency of large truck included awards to such prominent non-U.S. owned companies as Daimler and Bosch, as well as Chrysler. [29]

One recent controversy at DOE concerns the rules regarding national preferences and foreign eligibility for the first round of awards by the new Advanced Research Projects Agency-Energy (ARPA-E). These awards were made with part of $400 million from the 2009 economic stimulus law, the American Recovery and Reinvestment Act. DOE provided this summary about national preferences and foreign eligibility for this first round of awards:

> *The lead organization that will enter into the agreement with ARPA-E must be a U.S. entity. Foreign entities (entities that are directly or indirectly owned or controlled by a foreign company or government) may only participate as part of collaboration, consortium, or other teaming arrangement, and may not lead the team.*
>
> *A minimum of 90% of the work, as defined by total project costs, must be performed on U.S. soil, which includes the United States proper and its territories.*
>
> *If a foreign entity participates in the proposed R&D project, no more than 25% of the ARPA-E funds may be expended by the combination of all foreign entities on the project (excluding equipment that is not available in the United States). This restriction applies to the combined performance of the foreign entities, regardless of whether the work is performed in the United States or a foreign location.*[30]

On May 26, 2009, the Organization for International Investment, a trade association of foreign-owned companies operating in the U.S., wrote to Energy

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[29] U.S. Department of Energy, "Secretary Chu Announces $187 Million to Improve Vehicle Efficiency for Heavy-Duty Trucks and Passenger Vehicles, January 11, 2010."

[30] U.S. Department of Energy, "Frequently Asked Questions," "Opportunity: Recovery Act – ARAR-E," August 17, 2009, https://www.fedconnect.net/FedConnect/?doc=DE-FOA-0000065&agency=DOE, Tab "Frequently Asked Questions – Amend 6, page 9.

Secretary Steven Chu expressing concern about this requirement. The letter argued that:

> *This discriminatory treatment of [U.S. subsidiaries of foreign-based multinationals] is not mandated by applicable law or regulation. Restricting the ability of these companies and their American workers to fully participate in the program and compete for program funds undermines the effectiveness of the program, calls into question the U.S. commitment to a nondiscriminatory environment for foreign investment, and invites similar protectionist retribution from other countries. We urge you to reconsider these restrictions….*[31]

On July 29, 2009, Secretary Chu responded. In part, his letter said the following about this first ARPA-E funding opportunity announcement (FOA):

> *The first ARPA-E FOA provisions sought to strike a thoughtful balance on the issue of foreign participation, permitting a substantial role for foreign entities with the resources and capabilities to participate in the important transformational goals of ARPA-E, while meeting the stipulations of the American Recovery and Reinvestment Act [to stimulate the U.S. economy]. The second ARPA-E FOA will be modified based on other factors….*[32]

In December 2009, DOE relaxed these foreign-company restrictions for the second round of ARPA-E funding. A news report summarized the change:

> *Under the new solicitation, foreign-owned companies will be eligible for ARPA-E funding as long as they are incorporated within the US. In addition, a minimum of 90% of the work must be performed on US soil, as defined by total project costs, the solicitation states.*[33]

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[31] Letter from the Organization for International Investment to Secretary of Energy Steven Chu, May 26, 2009, http://www.ofii.org/docs/OFII_Letter%20_ARPA_E.pdf.

[32] Leteter from Steven Chu to Nancy Mclernon, OII, July 29, 2009, http://www.ofii.org/docs/ChuResponseLtr_0809.pdf.

[33] Herman Wang, "DOE relaxes foreign-company restriction in new $100 million funding round for ARPA-E," *Inside Energy*, December 14, 2009, available at: http://www.ofii.org/docs/energy_article_121409.pdf.

3.4 Basic Research Programs

Several federal agencies fund basic research in science and engineering, primarily basic research at universities. With some exceptions, these basic research programs do not fund foreign entities or researchers. Instead, the standard U.S. policy is for U.S. agencies to fund the Americans who participate in joint research projects and for other governments to fund their own researchers. This policy can be seen in several research agencies.

3.4.1 The National Science Foundation

NSF increasingly encourages international collaboration in science and engineering. However, NSF typically will only pay for the U.S. portion of any such collaboration. The following statement from the *NSF Grant Proposal Guide* sums up the agency's position:

> *Foreign organizations - NSF rarely provides support to foreign organizations. NSF will consider proposals for cooperative projects involving US and foreign organizations, provided support is requested only for the US portion of the collaborative effort.*[34]

3.4.2 NASA Research Programs

NASA has a policy similar to NSF's. The following statement comes from the agency's main guidebook for proposers responding to a NASA research announcement (NRA) or cooperative agreement notice (CAN):

> *NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the*

[34] National Science Foundation, *NSF Grant Proposal Guide*, NSF 04-23, September 2004, http://www.nsf.gov/pubs/gpg/nsf04_23/1.jsp#IE. NSF actually has the authority under its enabling statute to make grants to non-U.S. entities, if the U.S. Department of State concurs. This issue is discussed at some depth in an earlier report by TPI: G.R. Heaton, Jr., C.T. Hill, P. Windham and D.W. Cheney, *International Cooperation in Science and Technology: Strengthening Ties Between the United States and Japan*, Report to NEDO, September 2006. See especially pp. 15-17.

> *participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.*
>
> *All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.*
>
> *Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.*
>
> *Depending on the nature and extent of the proposed cooperation, these arrangements may entail: (i) An exchange of letters between NASA and the foreign sponsor; or (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).*[35]

3.4.3 Department of Energy Basic Research Programs

DOE's university research programs also often restrict government funding to U.S. universities. One example is a recent request for proposals (which DOE calls "Requests for Pre-Applications, or RPAs) from DOE's Office of Nuclear Energy. It focuses on nuclear energy research at universities.

> *The lead applicant must be a U.S. university or college. Collaborations between universities and industry or national laboratories are permitted. A*

[35] National Aeronautics and Space Administration, *Guidebook for Proposers Responding to a NASA Research Announcement (NRA) or Cooperative Agreement Notice (CAN)*, January 2010, pages B-5 and B-6. http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2010.pdf.

> *maximum of 20 percent of an award can go to industry and national laboratories.* ***Note that funding is for U.S. researchers only. Collaborations with foreign organizations are allowed if their role is focused on fundamental research and they are not a denied party or a party that requires an export license. Foreign organization participants are not eligible for U.S. funding.***[36] *[emphasis in the original]*

3.4.4 The National Institutes of Health

While most NIH grants go to U.S. researchers, NIH is the one major U.S. basic research agency that also funds foreign researchers. The reason appears to be that biomedical research in other countries can provide significant scientific and health benefits for the United States. In fact, NIH has an entire set of what it calls "foreign research opportunities." These programs fund a number of different types of grants, both "extramural" (funds to organizations and individuals outside of NIH's internal Clinical Center in Bethesda, Maryland) and "intramural" (at the Clinical Center). The extramural programs include support for the following types of researchers:

- Foreign researchers planning to conduct research outside the United States. There are special eligibility requirements for these awards, but the program is particularly for individuals from low- and middle-income countries. Institutions from upper income economies are not eligible.
- Foreign researchers planning to conduct research in the United States. Some types of NIH grants are not available to foreign researchers, but others are.
- Foreign institutions collaborating with a U.S. institution. In general, NIH can grant awards (except SBIR awards) directly to foreign institutions.

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[36] Nuclear Energy University Programs, Nuclear Energy Office, Department of Energy, "Request for Pre-Applications (RPA) No. NEUP-001019-Rev 1 for R&D Proposals," October 9, 2009, http://www.nuclear.energy.gov/pdfFiles/NEUP2010.pdf.

- Foreign students looking for opportunities to study in the United States.
- U.S. citizen-students looking for opportunities to study outside the United States.

NIH makes Intramural awards to the following types of researchers:

- Foreigner researchers planning to conduct research at NIH.
- Foreign students looking for opportunities to study in the United States.[37]

3.5 Some Concluding Observations About U.S. Policies and Programs

In sum, U.S. agencies have different policies regarding national preferences and foreign eligibility for different types of programs serving different government missions.

Acquisition agencies tend to want the best technology available from any trustworthy source, so long as national security and export control requirements are met.

Programs whose purpose is to help build technological capability for economic purposes tend to be more restrictive, although historically the U.S. Government has not created a single, uniform policy regarding foreign eligibility in these programs. Some programs are open to companies regardless of ownership, so long as they agree to manufacture resulting products in the U.S. Other programs are restricted to U.S. citizens and permanent residents. The ATP and TIP combine requirements for domestic manufacturing with reciprocity requirements.

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[37] National Institutes of Health, "Foreign Grants – Special Guidance for Foreign Research Opportunities," http://grants.nih.gov/grants/foreign/special_guidance.htm. Additional information is available at: http://grants.nih.gov/grants/foreign/.

U.S. basic research agencies encourage American researchers to collaborate with researchers in other countries. However, most of these agencies, with the partial exception of NIH, will only fund the U.S. portion of such collaborative projects. Foreign partners are expected to get research funds from their own countries.

4. NATIONAL PREFERENCES FOR PUBLICLY-SUPPORTED R&D PROGRAMS IN EUROPE

4.1. Chapter Introduction

This section examines the policies and practices of selected European countries and the European Union regarding national preferences in publicly-supported R&D programs.

As individual states, countries of Europe differ substantially in size, industrial structure, and technological capabilities, as well as in their recent histories and governance systems. So, we should not necessarily expect that they have adopted similar approaches to the national preferences issue.

At European level, there is a very considerable effort to encourage international cooperation in R&D programs within Europe, especially but not only for programs intended to strengthen economic performance of Europe as a whole.

We examine these policies below, beginning with those of the European Union.

4.2. European Union

4.2.1. Framework 7 Program

In the mid-1980s, the European Commission established the first Framework Program to subsidize R&D of relevance to technological innovation. From the beginning, Framework had the ancillary objective of encouraging cooperation among research entities in several countries, and it originally

imposed requirements that projects had to involve at least three countries in the European Union to qualify for support. This was in keeping with the larger European "project" of building an economically strong, politically unified Europe. The latest version of Framework has relaxed the international teaming requirement and includes a program for awards to teams in a single eligible country.

Each Framework program has had a life of several years. The current program, Framework 7, was established in 2007 and will continue until 2013. It has a total budget of over € 50 billion.[38] It has two main strategic objectives:

- *Strengthen the scientific and technological base of European Industry*
- *Encourage its international competitiveness, while promoting research that supports EU policies.*[39]

Framework is quite open to participation from every country, although the conditions for participation vary depending on the country and its circumstances. The key rules can be summarized as follows:

- EU member states participate fully
- A second group of countries closely "associated" with the EU, including Iceland, Norway, Lichtenstein, Turkey, Croatia, Israel and Switzerland, can also participate fully
- A third group of countries can participate fully in a Framework consortium, providing that the consortium has the minimum number of required participants from EU member states and associated countries. This group includes the International Cooperation Partner Countries (Russia, and other Eastern European and Central Asian States, developing countries, Mediterranean partner countries, and Western Balkan countries).

[38] European Commission, "FP7 in Brief," 2007, p. 6.
[39] Ibid, p. 7.

- High-income industrialized countries, such as Japan and the U.S., can also participate on a self-financing basis, with EU funding available only in exceptional cases.[40]

The last of the bulleted situations listed above is of greatest interest to Japan (and the United States). As noted, the standard attitude of Framework is that entities from Japan, the U.S. and other advanced countries can participate in Framework 7, but should not receive funding from the EU. In this case, "participation" means that the entity participates in and is named in the funding proposal, is a party to the contract between the EU that awards the funds and sets the terms of the contract, and is actively engaged in the conduct of the project. The entity, however, does not receive funds from the EU for its work, but must obtain funds from other sources.[41]

There are exceptions to the general attitude that entities in other advanced industrial countries should not receive EU funding. For example, nationals of all countries may compete for funding from the Ideas Programme within Framework 7. Ideas supports basic research only on the basis of excellence, although projects are implemented by teams of scientists working in European institutions.[42]

As another example of a specific understanding, under Framework 7, the U.S. National Institutes of Health and the FP7 Health program have signed an

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[40] Ibid., p. 11.

[41] For some U.S. entities, such as public universities and certain Federal agencies, the terms of contracts governing non-funded participation in Framework 7 have proven to be unacceptable and have served as a barrier to their participation even on a non-funded but "official" basis. The EU has made efforts to resolve these problems, but some challenges remain. See: Delegation of the European Union to the USA, "Transatlantic Cooperation in the European Seventh Framework Programme for Research and Development: A Guide for U.S. Users," December 2009. See also pages 53-55 in Manfred Horvat and Keith A. Harrap, "Review of the Science and Technology Cooperation Between the European Community and the United States of America 2003-2008," Brussels, European Commission, Directorate General for Research, January 2009.

[42] "Transatlantic Cooperation," op cit., p. 5.

agreement under which Americans and Europeans can apply for and receive funding from the other country's program.[43]

And, special provision may be included in a specific work program under Framework 7 to enable funding of high income advanced country researchers if EU officials determine that this approach would best serve Europe's needs.[44]

To facilitate international cooperation and participation, the EU has entered into bilateral science and technology cooperation agreements with nearly 20 countries. In November 2009, leaders of the EU and Japan signed such an agreement, which will come into force once it is ratified by both parties some time in 2010. The agreement:

- *describes the basic principles underlying the agreement: mutual benefit, reciprocal participation, exchange of researchers*
- *establishes a joint research committee which regularly meets to review and define bilateral cooperation activities*
- *determines specific rules governing the participation in the Parties' research programmes and the treatment of intellectual property rights in cooperative research activities.*[45]

4.2.2. Technology Commercialization Under Framework 7

Not surprisingly, the Framework 7 program regulations express considerable interest in how the partners in a team both manage and commercialize intellectual property resulting from a Framework project. Here we focus on technology transfer from a project team to another entity—typically

[43] Ibid, p. 8.
[44] Ibid
[45] EU Press Release, November 30, 2009. http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1844&type=HTML&aged=0&language=EN&guiLanguage=en/

a for-profit company—for commercialization. EU officials express a strong preference for commercialization to take place within the EU. Article 43 of the Framework rules states as follows:

> *The Commission may object to the transfer of ownership of foreground, or to the granting of an exclusive licence (sic) regarding foreground, to third parties established in a third country not associated to the Seventh Framework Programme, if it considers that this is not in accordance with the interests of developing the competitiveness of the European economy or is inconsistent with ethical principles or security considerations.*
>
> *In such cases, the transfer of ownership or grant of exclusive licence (sic) shall not take place unless the Commission is satisfied that appropriate safeguards will be put in place.*[46]

This provision is not unlike the analogous provision of the Bayh-Dole Act discussed in Chapter 3 of this report. However, the EU rule would appear to give program officials greater discretion in objecting to, as well as in approving of, a transfer of technology under license to a non-European entity.

4.2.3. Observations on National Preferences in European Union Programs

The EU supports the world's largest program to fund R&D related to the performance and competitiveness of industrial firms; namely, the Framework 7 Program. From its relatively modest origins as an effort to strengthen European industry by building ties among the Member states of the EU, Framework has grown into a major instrument of both European development and Europe's foreign policy. As Framework has matured, it has opened its funding window to

[46] "REGULATION (EC) No 1906/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 laying down the rules for the participation of undertakings, research centres and universities in actions under the Seventh Framework Programme and for the dissemination of research results (2007-2013), Article 43— Preservation of European competitiveness and ethical principles." http://ec.europa.eu/research/participants/portal/ShowDoc/Extensions+Repository/General+Documentation/Legal+basis/Rules+for+participation/ecrulesforparticipation_en.pdf

an increasingly broad array of performers from non-EU states, so that today nearly every country can participate in and, at least under certain circumstances, receive funding from its programs. One should not lose sight of the fact that Framework continues to be motivated by the intention to serve the interests of Europe, but those interests are increasingly seen as being international in scope, which can include participation by non-EU entities when it serves Europe's interests.

From a U.S. perspective, at least, the realities of cooperation with Framework remain challenging and, often, vexing. In comparison with the rules governing Framework 6, the Framework 7 rules are somewhat more responsive to the circumstances governing many performers of R&D in the United States. And, EU officials, not only in the Directorate General for Research but also in the legal affairs office, seem willing to consider additional modifications to facilitate co-operation with the United States.[47]

4.3. National Preferences in R&D Programs of Selected European States

4.3.1. Section Overview

In addition to their joint support of R&D through the European Union and such programs as Framework 7, the individual states (countries) of Europe have programs to fund R&D related to the needs and opportunities of the private sector. These programs operate under their own sets of national policies and practices regarding such matters as giving preference to country nationals and as participation of non-national entities. A recent report to the European

[47] One of the authors (CTH) participated in public discussions of ways to improve cooperation of U.S. entities with Framework 7 hosted by the Delegation of the European Commission in Washington, DC, on December 9, 2009.

Commission points out that there is little systematic collection of information and data on both policies toward, and level of activity in, participation by non-nationals entities:

> *Only limited data is available about the 'openness' of nationally funded research and technology development programmes to overseas partners. That data which does exist suggests that the share of the budgets that are spent on international activities within national programmes is still low even where they are open in principle. There is some evidence that universities and research institutes may be more ready and willing to internationalise than are companies, suggesting that universities and institutes could play an important role in linking different national research and innovation systems.*[48]

A study done in 1999 by a consortium of consulting firms led by Technopolis, Ltd., of the U.K. compiled information on the policies of 18 EU and EEA countries regarding the openness of their national R&D program to participation by non-national entities.[49] While the information in this study's two reports is undoubtedly out-of-date, the study does provide a useful discussion of the categories of national R&D programs from the perspective of international participation, and the country summaries in Volume 2 provide useful benchmarks of national policies as of a decade ago.

The authors noted that such programs can be put into three categories:

- Category 1—Programs explicitly foresee the participation of non-residents
- Category 2—Programs do not exclude non-residents explicitly
- Category 3—Programs exclude non-resident research groups.

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[48] P. Boekholt, J. Edler, P. Cunningham and K. Flanagan, editors, "Drivers of International Collaboration in Research—Final Report," Directorate General for Research, European Commission, 2009. http://ec.europa.eu/research/iscp/pdf/drivers_sti.pdf

[49] Technopolis, Ltd., et al., "Cross-Border Cooperation within National RTD Programmes," Volume 1, Main Report, January 1999. ftp://ftp.cordis.europa.eu/pub/improving/docs/g_strata_rpt_crossborder_1.pdf Detailed information on each country's policies is in Volume 2, Compendium of National Reports, December 1998. ftp://ftp.cordis.europa.eu/pub/improving/docs/g_strata_rpt_crossborder_2.pdf

They offer some insights into the relative prevalence of each type of program as of 1999. Because the international R&D arena has changed so dramatically over the past decade, we do not report or summarize those findings here. They can be found in the original study. The point remains true, however, that programs differ as to their intent by country and purpose, and it would be a mistake to take the policies and practices surrounding any single program in a country as indicative of a general policy or practice in that country.

In the remainder of this section, we review selected policies of two of the most important countries of Europe, the United Kingdom, owing to its size and the strength of its R&D infrastructure, and Finland, owing to its being one of the most dynamic smaller countries of Europe.

4.3.2. United Kingdom

The United Kingdom has had an array of programs to support R&D related to industrial technology. The administration of these programs has been quite dynamic, with frequent changes in government organization and in the names and responsibilities of the cognizant ministries. In addition, the U.K. has established various non-governmental bodies, such as the Technology Strategy Board, to administer some of its programs. The result of this complex and changing program environment is that it is difficult to discover any general set of guidelines regarding national preferences in its programs.

The UK government published in 2004 a comprehensive policy statement entitled, "Science & innovation investment framework 2004-2014."[50] Chapter 9

[50] "Science & Innovation Investment Framework 2004-2014," 2004. http://webarchive.nationalarchives.gov.uk/20100407022214/http://www.hm-treasury.gov.uk/spending_sr04_science.htm (Please note that all U.K. government web sites are under revision as of the completion of this report as the result of the recent parliamentary election and change of government. The web pages posted by the previous government are now available only as archived pages.)

of this report devotes substantial attention to the opportunities inherent in international cooperation in R&D for numerous purposes.[51] While this section of the investment strategy extols the virtues of international R&D collaboration, it offers no comments on the question of national preferences in R&D programs funded by UK governments at any level. Likewise, an extensive search of UK departmental official web sites did not discover any policy statements regarding national preferences or the availability of funding or participation in UK programs for non-national entities.

Volume 2 of the 1999 report by Technopolis referred to earlier at pages 42-47 provides details of the role of national preferences in the administration of UK R&D programs carried out under the general umbrella of a UK government 1993 White Paper on science and technology policy, the predecessor of the 2004-2014 document mentioned above.[52] That report also notes that the general policy statement (the White Paper) is silent on the issue of national preferences and that one must turn to the detailed rules and guidelines issued by specific ministries and departments of the UK government to determine their practices on these issues.

For example, the UK's Technology Strategy Board has cognizance over "Collaborative R&D Projects" within the Small Business Research Initiative (SBRI) program on behalf of the U.K. Department for Business Innovation and Skills that provides funds under contract to small firms for research activities of modest scale. It provides funds for a "first feasibility phase" that is generally limited to 6 months and a maximum contract of £100k. After an assessment of

[51] Chapter 9 in "Science and Innovation Investment Framework," entitled, "Global Partnerships, Devolved Administrations and the Regions," 2004. See especially pages 127-137 at: http://webarchive.nationalarchives.gov.uk/20100407022214/http://www.hm-treasury.gov.uk/d/spend04_sciencedoc_8-9_090704.pdf

[52] Technopolis, Ltd., op cit.

results, companies may receive a second phase contract for up to 2 years and £1m for more detailed product development.[53]

The guidance documents for the SBRI program do not specify that eligible firms must be U.K. owned or controlled. They do require, however, that the research project leading to a proposed SBRI contract must have been conducted in the U.K.[54]

The Technology Strategy Board also has responsibility for major U.K. government research programs in the field of energy, as well as a number of other fields and areas of application.[55] A major part of the Technology Strategy Board funding supports collaborative research involving two or more companies, as well as universities and other organizations. The TSB evinces a clear preference for the projects it funds to be conducted by U.K. enterprises that do their research in the U.K. and that exploit the results of their research within the U.K. or the larger European Research Area.[56] However, exceptions are possible. The following statements are quoted from FAQs 25, 26 and 31, respectively, of the TSB FAQs document.[57]

> *FAQ 25:* ***What if my research partners are not in the UK?***
>
> *A key aim of The Technology Strategy Board's support is to help improve the UK's innovation performance. Collaborators outside the UK - EU and non EU - are acceptable, but there must be a clear and substantial gain for the UK brought*

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53 http://webarchive.nationalarchives.gov.uk/20100407022214/http://www.innovateuk.org/deliveringinnovation/smallbusinessresearchinitiative/howsbriworks.ashx

54 "TSB Guidance for applicants for Technology Strategy Board Competition," http://www.scribd.com/doc/20153047/TSB-Guidance-for-applicants-for-Technology-Strategy-Board-Competition

55 Technology Strategy Board, "Energy Generation and Supply 2008-2011," 44 pages, http://www.innovateuk.org/_assets/pdf/Corporate-Publications/EnergyGenSupply_strategy.pdf

56 Technology Strategy Board, "Competition FAQs," http://www.innovateuk.org/competitions/competitonfaqs.ashx

57 Ibid.

> *about by their involvement. [underlining added for emphasis] If you are considering the involvement of an international collaborator in your consortium you may wish to contact the Technology Strategy Board helpline to seek further clarification of how their involvement should be treated.*
>
> *FAQ 26:* ***Can a UK company do work outside the UK or Europe within the project?***
>
> *A key aim of Technology Strategy Board support is to help improve the UK's innovation performance. It will be up to the applicants to convince the Technology Strategy Board that supporting work and building intellectual capital outside the UK will meet the key aim. Note that work done outside the UK will not attract funding [underlining added for emphasis], although the project costs associated with the overseas work may in exceptional circumstance be included when calculating total project costs.*
>
> *FAQ 31:* ***Where and by when am I required to exploit?***
>
> *The default grant offer condition is that exploitation of the results of the project must not be outside of the European Economic Area [underlining added for emphasis] within a period starting on the Offer Letter date and ending five years after the date on which final payment of grant is made. If applicants are able to demonstrate that it would be of major positive economic benefit to the UK and strengthen UK GDP to also exploit the results outside of the European Economic Area, the Technology Strategy Board may grant an assent to vary the Offer Letter. However, this will be in exceptional circumstances only and considered by the Technology Strategy Board on a case-by-case basis.*

In the U.K., the various government-sponsored research councils are the main providers of grants to academic institutions for the conduct of research. Of the seven councils currently in operation, the Engineering and Physical Sciences Research Council (EPSRC) may be of greatest relevance to the present study. According to the Funding Guide for the EPSRC, "All UK Higher Education Institutions (HEIs) may apply for research grants." Furthermore, "Certain elements of funding are also open to approved Independent Research Organisations [non-profit organizations]." Beyond that, "Principal Investigators must be academic employees (lecturer or equivalent) of an eligible organisation

and must be resident in the UK."[58] Taken on their face, these eligibility standards would appear to militate against participation by non-U.K. institutions and non-U.K. principal investigators in EPSRC programs.

4.3.3. Finland

In 2008, Finland's investment in R&D totaled some 6.4 billion euros, of which the private sector accounted for 72%.[59] Several government agencies support R&D. The Academy of Finland, which focuses on competitive research grants to universities and research institutes, has an annual budget of about 300 million euros. The main agency for funding research, development and innovation in Finland is Tekes, the Finnish Funding Agency for Technology and Innovation.[60] Tekes invests some 500 million euros in projects intended to enhance the performance of companies and other organizations operating in Finland.[61] Both Tekes and the Academy actively promote internationalization of R&D and innovation involving Finnish researchers and companies, including support for visiting researchers from abroad and participation in their funding programs by foreign firms that have a legal presence in Finland. Tekes maintains offices in China, Japan, the United States, and Europe (Brussels).

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[58] "EPSRC Funding Guide," January 2010, p. 11. http://webarchive.nationalarchives.gov.uk/20100407022214/http://www.epsrc.ac.uk/SiteCollectionDocuments/FundingGuideJanuary2010.pdf

[59] Academy of Finland, "Sourcing for the Best Science and Research," 2009, page6. http://www.aka.fi/Tiedostot/Tiedostot/Viestint%C3%A4/Lyhyesti-esite/AKA_lyhyesti_EN.pdf

[60] See on the Web: http://www.tekes.fi/en/community/Home/351/Home/473

[61] This investment by Tekes in research related to innovation is very large for a country the size of Finland. By way of comparison, the economy of the United States is approximately fifty times larger than Finland's. Thus, if the United States were to make an equivalent commitment to such an agency, it would have a budget of some 25 billion euros, or about $34 billion. By comparison, the budget of the U.S.'s flagship innovation program, the Advanced Technology Program in the Department of Commerce, never exceeded $450 million. That is, the Tekes budget, on a normalized basis, is consistently more than seventy-five times larger than ATP at its largest.

Tekes is open to participation by international companies that do business and/or perform R&D in Finland. Here is guidance from Tekes regarding availability of its funding to international companies:

> *Tekes's customers include companies, universities, research institutions, government organisations, local and regional authorities and other organisations operating in Finland.*
>
> *Tekes can finance R&D projects undertaken by foreign-owned companies registered in Finland. International companies with R&D activities in Finland do not need to have a Finnish partner to be eligible for funding. The financed project should, however, contribute to the Finnish economy.*[62]

Tekes provides the following services, free of charge, to international companies:

- *Expertise and information about research and development networks in Finland*
- *Contacts and assistance to establish a business*
- *Extensive regional network*
- *Funding for development projects for companies registered in Finland.*[63]

Tekes is even more welcoming to individual researchers and groups from other countries that wish to cooperate with Finish researchers in universities. Here is guidance to such researchers from Tekes:

> *Tekes funds public research at Finnish research institutes and universities. International cooperation and researcher mobility are encouraged in all research projects, and extensive international cooperation will be rewarded with greater funding participation.*
>
> *In joint projects, Tekes can offer funding for your Finnish partner.*
>
> *Tekes offers funding for international researcher mobility as part of the research project carried out by a Finnish research group.*

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62 http://www.tekes.fi/en/community/For%20international%20companies/347/For%20international%20companies/1241

63 Ibid

> ***FiDiPro - Finland Distinguished Professor Programme*** *offers funding to projects recruiting highly merited international researchers in Finnish universities and research institutes to create long-term collaboration in science and technology.*
>
> *Tekes invites* ***NSF Graduate Research Fellows*** *to team up with leading Finnish research groups through the Nordic Research Opportunity in Finland initiative.*
>
> *We encourage companies to recruit international researchers or consultants to their projects in Finland, and to engage in research carried out by research teams abroad.*[64]

Thus, as is evident Tekes views participation by researchers from abroad as a valuable contribution to growing the Finnish economy. At the same time, Tekes imposes expectations about such participation that are intended to focus such collaboration on activities that are in the interests of Finland. Note that Finland does not impose reciprocity requirements on nationals of other countries.

The Academy of Finland, which focuses its funding on academic institutions, is also committed to supporting international activities and the participation of international researchers in projects in Finland.[65]

> *All Academy of Finland funding opportunities are intended to promote the international networking and activities of Finnish researchers, and to support them in their international collaborations at foreign universities and research institutes. The Academy also seeks to attract the interest of foreign researchers in Finnish science and research environments. The overall objective is to raise the level of research being done in Finland and add to the international element of Finnish research environments.*

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[64] http://www.tekes.fi/en/community/International%20researchers/349/International%20researchers/1242
[65] http://www.aka.fi/en-gb/A/For-researcher/Funding/International-coopearion/ (the typo in "cooperation" is in the original)

> *The Academy supports international cooperation on a broad front, such as through researcher mobility and international joint projects. Funding for these activities can be applied for within all Academy funding opportunities.*[66]

The Academy funds the Finnish part of international research consortia, according to the following guidelines:

> *A consortium may be international, particularly when the Academy's research programme concerned involves international cooperation between research funding agencies. The Academy mainly funds only the Finnish partners of a consortium by granting funding to the Finnish sites of research. The Academy's international partner (or partners) funds the other partners in the consortium. In the international consortium application to be submitted to the Academy for review, the Finnish partner of the consortium is indicated as the consortium leader. In other respects, the Academy's consortium guidelines are to be followed.*[67]

4.3.4. Observations on National Preferences in the U.K. and Finland

The preceding brief reviews of how the United Kingdom and Finland address the challenges of national preferences in their critical national R&D and technology development programs give a sense of what the leading countries of Europe are doing in this area. Each country is open to international participation, yet each country is also careful to define the terms of such participation, generally focusing on efforts to ensure that the projects they fund or that they assist will yield results of use to the funding country in tangible ways.

At the same time, neither country appears to have imposed on international cooperation any formal expectation of "national treatment" or "reciprocal access." Furthermore, each country appears to have given R&D

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[66] Ibid.
[67] http://www.aka.fi/en-gb/A/For-researcher/How-to-apply/Application-guidelines/Consortium-application/

program managers a certain amount of discretion in determining whether a particular proposed project is in their national interest and, thus, whether it should be supported. This seems to be a characteristic of many such programs, including those of the European Union discussed earlier, as well as some programs in the United States, discussed in Chapter 3. It would appear, therefore, that a kind of international consensus has formed around the idea that a formulaic approach to national preferences is neither necessary nor desirable—circumstances and opportunities in R&D and technology development are far too diverse for standard operating procedure to fit all cases appropriately.

5. CONCLUSIONS: ISSUES IN DESIGNING POLICIES FOR NATIONAL PREFERENCES

Preferences for "national" participants in publicly-supported R&D programs have long been a common feature of technology policies throughout the U.S., Europe and Japan. In the U.S. context, most of the policies now in place were enacted about 20 years ago, during a period of intense concern with "competitiveness," particularly in relation to Japan, and they therefore create a variety of restrictive conditions for non-national participants. In Europe, whose R&D enterprise is much the most international of the three regions, public policy has struggled to craft policies that are open yet protective of the national interest. In Japan, where foreign-enterprise R&D accounts for only a small percentage of the total, increasing openness is desirable but difficult to achieve.

In spite of the fact that globalization of R&D activity has increased markedly since the 1990s, there has been little change in the policy framework for national preferences. Beneath an apparently static set of policies, there is nevertheless a nascent reevaluation of national preferences, which makes this report especially timely. In designing new policies that express a preference for national participants in R&D programs, the following issues, highlighted in this report, need to be kept in mind.

- Whether the traditional *reasons offered in support of national preferences* still hold validity? These include: 1) advantage in international competition, 2) taxpayer equity, and 3) domestic politics.

- Whether the *rationales for openness in R&D programs* have become more persuasive? These include: 1) a recognition of the increasingly global

spread of R&D talent, 2) the desire to have the best possible participants included in R&D projects, and 3) considerations of international diplomacy

- Which of the *design possibilities for national preferences* hold most continued usefulness? These include: 1) restrictions on firm incorporation and ownership, 2) restrictions on the location of R&D, licensing and manufacturing, 3) broad considerations of "national economic interest," 4) reciprocity in the treatment of foreign firms in the home country of a potential foreign participant in an R&D project.

- Whether the *administration of a national preference policy* can still be successfully carried out, given international corporate ownership patterns which have rendered corporate "nationality," an increasingly blurry and changing concept.

- By what *reference points* should administrative decisions about foreign eligibility be made – whether focused on the characteristics of individual firm participants? Or the characteristics of participants' home countries?

- How can administrative decisions on national preference take account of *frequently changing technological capabilities and policy changes* in the countries they seek to assess?

- Do the *traditional U.S. criteria for determining foreign eligibility* – corporate ownership, domestic technology development and the national economic interest – have continued validity and practicability today?

- Does the *traditional European approach* – encouraging foreign participation, imposing expectations that it will ultimately contribute to the national interest, and lodging considerable discretion in program managers – have continued validity?

- What *knowledge and what kind of process* are necessary for good decisions with respect to national preferences in a highly globalized R&D context?