II. Issues Discussed at the Workshop

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A. Infrastructure

Since the publication of *Science the Endless Frontier* there has been increased recognition of the role of scientific research as an agent of change. Moreover, throughout the industrial world the past twenty-five years have witnessed a period of great experimentation with the organization of scientific and technological research; the principles employed for the allocation of R&D resources in the public and private sectors; the incentives provided to individual scientists; and the mechanisms for translating scientific discoveries into innovation, economic growth, and increases in the quality and standard of living. Scientific research has created new industries such as biotechnology, nanotechnology and telecommunications. Understanding RPAC issues in this context requires an effective research infrastructure.

The United States was formerly the undisputed world leader in scholarship and research on science and technology policy. Unfortunately, the investment of public resources in "research on research" has not kept pace with the growing salience of science and technology policy. The United States has abdicated its position of international leadership in this important field to scholars from other nations, notably the European Union countries. European initiatives have funded both the collection of data on science and technology (S&T) indicators and social science research projects to study these issues. A series of international changes in the funding and incentives for research that are not recognized and appreciated in the United States have important implications for future international economic competitiveness.

Important questions related to how societal needs are measured and articulated, how businesses and industries respond to those needs with technological innovations, how politics, markets and legal institutions encourage or impede technologies, and how society employs technology and addresses its unintended consequences are all components of research policy. Empirical work on these topics often relies on original data collection, which may be funded by a variety of federal and state agencies or private foundations. These efforts are often uncoordinated. In addition, federal government agencies may lack objectivity, owing to their role as research sponsors.

The current situation is unfortunate. Studies of research policy are undersupported at a time when Congress has made a significant commitment to establishing accountability in federal agencies through the Government Performance and Review Act (GPRA). Implementing GPRA requires greater accountability on the part of government agencies and commits the U.S. government to expanded formal evaluation of the formulation and realization of the "strategic goals" of public agencies, including the major government funders of research in the United States. Effective implementation of these processes requires a critical mass of capable researchers. More than mere irony is implicated here: a naïve or unsophisticated approach to the evaluation of S&T strategies, programs and priorities could prove harmful; for example, by shifting attention to short-term outcomes to the detriment of long-term goals.

The NSF HSD Agents of Change program could mobilize the community of S&T scholars and create a research agenda that would enhance understanding of the innovation process. Three infrastructure initiatives were mentioned at the Tucson Meeting involving data collection, community building, and training the next generation of scholars. Each of these is described in turn.

1. Data, Methodology, and Metrics

One component of infrastructure is data resource development, specifically the development of web-based resources and project archives that would provide access to quantitative and qualitative data to support RPAC research. While NSF funds many projects that collect data that might be useful to RPAC, there is limited dissemination of information about the types of data currently available and how these data may be accessed. The costs of research projects to analyze such data are significantly less than the costs associated with the original effort to collect them.

A compendium cataloging S&T policy and research data could help catalyze the community of scholars. There have been other efforts that attempt to inventory data. While these efforts provide a good baseline to build upon, they lack an evaluative component that highlights the limitations of the data. Most notably, the existing surveys tend to focus on governmental data sources and do not mention data sources created and made available to scholars through NSF funding. In addition, existing data compendiums do not cover privately collected proprietary data which are increasingly used in the literature.

The European Union is supporting the Community Innovation Survey (CIS) with the purpose of strengthening the empirical basis for policy related to innovation in Europe. Launched in 1991, CIS is a collaborative project of the Member States and the European Union. The survey collects data on commercial firms at the enterprise level. The time series is the basis for a large number of academic papers. There is no equivalent or comparable data source in the United States.

Some of the most interesting current work links different data sources to provide a more integrated temporal picture. Often these data come from different federal agencies. This is a new research frontier only made possible by advances in computing and matching algorithms. There are also a set of privacy laws, which although intended to prohibit commercial firms from exploiting personal data, may limit the ability of academics to analyze these data. Scholarly research would benefit from a set of standards, policies and procedures regarding access to such data. Currently, access is negotiated on an individual basis, which is inefficient. Moreover, access to data is often limited even though scholars may be able to file Freedom of Information Act (FOIA) requests. Significant public resources are spent collecting these data and their analysis could yield information to benefit society. The lack of access to data frustrates researchers, and the time delay and uncertainty in securing data limit scholarship, especially for young scholars facing tenure pressures.

There is also a need to develop new statistical techniques to provide better measures of research output and to better conceptualize and measure policy outcomes. The need to promote activities to advance the effective discovery of knowledge from data was mentioned repeatedly by workshop participants.

An NSF program of S&T policy research should include assessment and research on mission agency R&D programs, including those of DoD, NIH, NASA, and DoE. These mission agencies account for far more federal R&D spending than does NSF and in many instances, mission-agency R&D programs have relatively clear objectives. Some of the most important basic research advances, as well as technological innovations produced in the postwar United States (e.g., the Internet, biotechnology, the discipline of computer science), owe a great debt to mission-agency R&D funding.

2. Community Building Activities

The diverse disciplines involved in studying RPAC topics could form a community of common interest and mutual respect. Towards this end, activities that could foster community include a set of thematic conferences that would incorporate interdisciplinary perspectives, promote collaboration, and diffuse new ideas and methodologies. Similar efforts are underway in Europe. For example, more than 100 delegates representing 42 research centers participated in the first meeting of the Policies for Research and Innovation in the Move towards the European Research Area (PRIME) Network of Excellence in Madrid on January 8-10, 2004. The objectives are similar to the RPAC. Network activities are funded under the European Union Sixth Framework program for five years.

Community building efforts should extend beyond the immediate community of RPAC scholars to include other stakeholders in the scientific community. The topics considered under this new initiative would benefit from cross-directorate collaborations. While many programs call for social science evaluation, these efforts are often not integral to the project. Scientific professional associations also have concerns about RPAC issues. These efforts would provide a closer connection between RPAC research and those who might put it to practical use. In addition, the participants mentioned outreach to other stakeholders, such as university administrations, politicians, and the press, about RPAC research questions and capabilities. These stakeholders affect resource decisions and public opinion. Inviting them to conferences or short courses to promote a dialogue would help to build awareness of RPAC issues.

3. Training the Next Generation of Scholars

The final infrastructure item is the systematic encouragement for research on these and related topics by Ph.D. students from a range of relevant disciplines, including the history of science, sociology, political science, economics, and public policy. NSF programs typically provide dissertation enhancement awards as a special programmatic category and there was support for having this mechanism become a component of RPAC. In addition, additional funding to support graduate student travel to conferences could be included as a budget item.

One mechanism to encourage new scholarship in this field is an annual conference focused on research presentations by Ph.D. students who have been advanced to candidacy but have not yet completed their theses. Such conferences have been highly successful in other interdisciplinary fields, supporting the development of networks of students who subsequently become important figures in academia and other spheres. In addition, this annual conference could also award prizes for best student paper as a component of the RPAC program.

B. Beneficiaries of research policy

To mobilize support, policy makers usually identify broad benefits for the policies they seek to enact. The benefits described in the policy enactment phase are often sweeping. During the Cold War, the discourse on military research emphasized the societal benefits of national security. After the Cold War, the discourse around American competitiveness in global markets emphasized the importance of research in discovering new technologies, creating jobs and improving the economy, benefits that created a prosperous citizenry. The discourse around NIH funding emphasized the health benefits brought by research. Alongside the broad mission agency programs are efforts, such as the Experimental Program to Stimulate Competitive Research (EPSCoR), to broaden research capability in the several states. The states themselves increasingly support academic research, often through research programs aimed at economic development. But these discourses about benefits from research, however well developed, tell us little about concrete benefit distribution through the policy process.

Initially, workshop participants suggested that we might begin to study beneficiaries of research policy by looking at mechanisms that were already in place. For example, we might study how researchers and agencies comply with GPRA. In the same vein, "criterion two," which requires faculty seeking NSF funding to address the broader impacts of proposed research, could be studied systematically. Pursuing the mechanisms already in place for collecting data about research beneficiaries (GPRA, broader impacts) undoubtedly would repay investigation, but a broader approach to beneficiaries is even more important to pursue. Workshop participants considered beneficiaries of research policies from a number of viewpoints. These are grouped under the headings **patrons**, **mission agencies**, **institutions**, **politics**, **people**, and **policy**.

1. Patrons

The primary patrons of research are the federal government, corporations, and foundations. The federal government provides the lion's share of funding for basic research through mission agencies and NSF. As several of the participants noted, earmarking is increasing rapidly. Earmarking shifts funding to fields, programs and institutions that may not have previously benefited from funding. Universities are recipients of earmarks as are mission agencies. Corporations have increased their research funding, but only a few areas, such as biotechnology, have increased dramatically. Research on the complex interactions among patrons might increase Congressional and administrative understanding of the economic and social benefits of research to their constituents.

2. Mission agencies

Mission agencies are beneficiaries of research policy as well as patrons of institutions and individuals engaged in research. The mission agencies themselves should be studied. Although the mission agencies dispense funding, they often seek to increase their own budgets and the funding they dispense to create stronger, more powerful agencies that provide more benefits and opportunities for those who staff them.

3. Institutions

Many of the participants saw research universities as important beneficiaries of research funding. The small groups that discussed the possibility of an RPAC program agreed that research universities have undergone significant changes that call for careful evaluation. Institutional adaptations to changes in research policy, such as the creation of technology transfer offices, need to be studied. While research universities are beneficiaries of research policy, these benefits may have far-reaching and unintended consequences. Some of the questions raised by participants were: What advantages and disadvantages accrue to universities that engage heavily in research? How does research funding interact with internal institutional resource allocation? For example, does involvement of public universities in research diminish institutional resource allocations to undergraduate instruction, as current National Science Board data indicate? Does concentration of research funding in specific institutions over a long period yield better results—in terms of articles, patents, start-up corporations—than lesser rates of funding spread across more institutions?

Government laboratories and corporations are also beneficiaries of research policy. While there has been a great deal of scholarly work on the costs and benefits of innovation related research at universities, there has been less at government laboratories and corporations. To understand fully how research policy benefits institutions we need to study corporations and government laboratories as well. Moreover, universities, government laboratories and corporations are not the only institutions that produce science and benefit from research policy. We should broaden our study to look at civil society, in addition to the market and the state.

4. Politics

Many of the participants thought that general discourses about research beneficiaries—American competitiveness, job creation, economic growth, improved health—were political discourses useful in increasing funding for mission agencies. However, these discourses do not focus on which specific groups and institutions benefit from which research policies. There is difference between job creation, which politicians say is a benefit of research, and wealth creation. Large corporations in specific sectors, such as pharmaceuticals and defense, are often the beneficiaries of wealth creation. A number of participants argued that the distributional dimensions of the benefits of research policy need more attention, and some suggested that benefits should be widely dispersed.

5. People

A program that examines research policy as an agent of change should consider the variety of actors who have a stake in research policy. However, the stakeholders' model has some limitations in that only the persons "already at the table" are included, leaving out many others who may have legitimate interests. How do individuals and various groups benefit from research? Are they best served by economic growth, new technologies and public health, or are there many other benefits that can be identified? What are the roles of people and organizations that are not conventional science actors? For example, some NGOs are producing a kind of "paraknowledge" about science research. Are they beneficiaries of science policy, or could they be? Should they be? How do investments in research by NGOs differ from investments in research by other institutions?

6. Policy

A central concern of participants in the workshop was that the benefits of research policy not be considered solely in a narrowly instrumental fashion. It was pointed out that human institutions are difficult to engineer, and what some groups perceive as benefits are not seen in the same way by others.

In studying the beneficiaries and benefits of research policy, we should move beyond the broad benefits often attributed to science and technology and focus on a more specific question: What organizations, in what circumstance, are most effective in bringing the benefits of science to society: public institutions (i.e., government health programs, educational institutions), private non-profits (citizens groups, environmental alliances, health groups), or for-profits (market mechanisms)? We also need to know much more about how the policymakers and organizations that perform science assess its benefits. We need to know more about how they interact in deciding what to support, and respond to voices promoting or indicating concern about the direction and results of science.

The following outline highlights some research questions that an RPAC program might address. Unless we understand the processes through which benefits from research are distributed, and identify its direct and indirect beneficiaries as well as the costs others pay, we cannot craft policy that serves the citizenry well. As we move toward a knowledge society, in which research is increasingly important, the need to understand the benefits of research becomes more urgent.

I. How does research funding benefit the individuals and institutions that perform it?
   - A. Research universities.
     - i. What advantages accrue to universities that engage heavily in research; what disadvantages?
     - ii. How does research funding interact with internal institutional resource allocation?
     - iii. Does research funding stratify universities internally? For example, how do current patterns of research affect postdoctoral populations? If post docs do not attain faculty positions, where do they go? Will following their networks reveal how the benefits of scientific knowledge are dispersed across economic and social institutions?
     - iv. What are the implications of concentrations of research funding in a limited number of specific institutions?
   - B. Government laboratories
   - C. Corporations
   - D. NGOs

II. How does knowledge/discovery travel from research agencies to the broader society?
   - A. Examination of dissemination ideas in NSF proposals
   - B. Examination of how networks and mechanisms channel knowledge/discoveries
     - i. Patenting
       - a. Selection of patents to promote
       - b. Selection of corporations to license

c. Numbers of jobs created
d. Follow up that evaluates the social utility of the patent
e. Distribution of products and processes throughout society

ii. Know-how

III. What organizations are most effective in bringing the benefits of science to society? Public institutions, non-profits, for-profits?

IV. How do the policy makers and organizations that perform science receive feedback about benefits?
A. From what organizations?
B. Through what mechanisms?
C. What role do programs like GPRA play in feedback? What happens to the feedback; how is it monitored; how is information deployed?

V. What happens when there are no benefits; what happens if there are more costs than benefits; what happens if there are unintended consequences?

C. Unintended consequences of research policy

As previously noted, one workable definition of research policy is "a strategy for achieving developments of new knowledge, new forms of expertise, and new infrastructures," where infrastructure is understood to include not only material objects like satellites and supercomputers but also training programs and curricula. After recognizing the variety of groups, both public (e.g., courts, regulatory agencies, advisory bodies—at all levels of government) and private (e.g., for-profit firms and not-for-profit foundations as well as other institutions of civil society) that pursue such strategies, the workshop participants noted that not all strategies explicitly include attention to each component of knowledge, expertise, and infrastructure. Moreover, the participants recognized that research policy is often a consequence not explicitly formulated but is a resultant of other policy activities.

The breadth of research policy goals and its focus on new innovation, the diversity of effective actors, the often narrow cast of their agendas, and the interaction with other policy domains creates a policy environment with enormous potential for unintended consequences. This section offers a discussion of the unintended consequences of research policy, drawn from the discussions of the Tucson group and grouped under a list of five "P's": **people, programs, patrons, politics, and policy**. This list is encompassing but not exhaustive, and one could easily offer additional categories; but it captures many of the important elements discussed at the workshop. It also demonstrates the variety of levels of aggregation on which research policy has its impacts.

1. People

Research policy has actual and often unintended consequences on the individuals who perform research. The current system of emphasizing individual principal investigators has led to a number of unintended consequences, including the staffing of labs by postdoctoral fellows who receive modest compensation, the offering of training opportunities with sparse upside potential, and

the increasing use of foreign nationals in such positions (a consequence that has newly salient policy dimensions in an era of heightened security concerns). Simply increasing the pay to fairly compensate for poorly paid post-doctoral associates is likely to exacerbate other problems by continuing to attract young researchers, both domestic and foreign, to traineeships that still may not have full career potential.

Discussion of the role of foreign nationals in the U.S. science and engineering enterprise often relates to discussion of the "pipeline" of U.S. students and so-called "leaks" of students who do not emerge into science and engineering careers. Such "leaks" may have positive unintended consequences, as students trained to some degree in science and engineering bring that form of literacy to other careers in which such expertise is valuable, or even simply bring it to informed citizenship. We do not, however, track such "leaks" well.

Another kind of unintended consequence of research policy is on people who do not perform research, but who are the users or consumers of the products of research. Although a leading rationale for the public support of R&D activities is economic growth and job creation, these are indeed two separate phenomena and research may be more about wealth creation than job creation. The distribution of the benefits of research policy—both within the US and between the US and other nations—is rarely considered when policy makers make priorities between civilian R&D and military R&D or among particular strategies or approaches to public health and disease, but such priorities have profound impact on the way individuals live their lives.

There are unintended consequences of research policy for the subjects of scientific investigations as well. Human subjects protection, although relatively settled conceptually in the US for some time, has become unsettled recently with instances of financial conflicts of interest— an unintended social impact of research policies that encourage the use of financial incentives to spur innovation and technology transfer. More profound, possibly, are the potential consequences of the globalization of clinical research, perhaps stimulated by US human subjects requirements that move research to settings that allow experimentation to occur on more vulnerable populations. A proposed response, applying US rules to non-US sites, means that various experiments and drug trials may go undone.

2. Programs

Research policy has unintended consequences for the meso-level units of knowledge creation like disciplines and broad research agendas. At the workshop, some analysts emphasized the under-scrutinized influence of funding patterns on the organization and development of scientific disciplines and in the differing conceptions of disciplinarity, often associated with the lone principal investigator, and interdisciplinarity, often associated with larger centers. Some participants at the workshop also expressed the concern that interdisciplinary training could draw off talented people and prevent disciplines from retaining their strong intellectual bases.

Centers have economic, as well as intellectual, implications; because they provide a space for broader, inter-sectoral collaboration, they have a strong appeal for economic development. Other funding mechanisms beyond investigator-originated grants and center awards, e.g., prizes, may motivate R&D in different directions with a different set of intended and unintended consequences.

Similarly, funding mechanisms such as earmarking have an impact on the way research programs develop, particularly for individual research institutions that look to earmarks for institutional and infrastructural support. Other policies, especially those for anticipating or evaluating research outputs and outcomes (the NSF evaluation criteria concerning broader impacts and the federal legislation (GPRA) mandating assessment of federal R&D programs, respectively), may change the style of research or reorient research programs into directions that are perhaps more relevant but also plausibly more short-term and less productive over the long haul.

Often implicit in the discussion was the idea that research programs—both because of the economic orientation of policy makers and the cultural orientations of all involved—are largely aimed at national audiences in the wealthiest countries, leaving global concerns and the social needs of nations that cannot afford large-scale research programs neglected. Several participants at the workshop lamented the lack of institutions for debating and making research policy with a view toward its global consequences.

3. Patrons

It is widely recognized—and celebrated—that patronage for R&D in the US is highly pluralistic. That is, financial support for R&D comes from a wide array of private and public actors, and even within the public sector from a large number of agencies. What is less understood is how the patrons of R&D adjust to one another. For example, have foundations played a role in creating new fields of science where government funding has been more conservative? Workshop discussions also alluded to the question of what happens to private R&D spending when public spending moves in particular directions. Important issues also center on venture capital, an increasingly significant patron in the innovation system about which too little is known.

The consequences of attempting to exert political direction over public patrons are not well understood. Do we really know the effects of the Mansfield amendment, by which Congress restricted the Department of Defense to supporting only mission-related research and not basic research? In the contemporary funding environment, the emphasis of political direction over public patrons often involves issues of bioethics, as in the case of stem cells. But, if research patronage is now a global phenomenon, what is the hope of forbidding or controlling certain types of research?

4. Politics

Research policy is political through and through, and it has consequences for politics that range from its influence on the distribution of goods and services in societies to its influence on inquiries into human nature. The very success of research in promoting economic change, for example, has meant the creation of a politics in which every state and every university wants a share—putting increasing political pressure on peer review and other distribution schemes designed to insulate science from politics. But the upside of the inefficiencies of departures from strict peer review may be political support for the broader R&D enterprise, though this is sometimes purchased at the price of earmarks and carve-outs (or Experimental Program to Stimulate Competitive Research (EPSCoR) or Small Business Improvement Research (SBIR)). In either event, research institutions are now more enthusiastic political actors, the consequences of this activity for knowledge creation and other goals of research policy need examination.

Policies such as the Government Performance and Results Act, not initially designed specifically for R&D, change the politics of research policy by shifting emphasis to certain measured outcomes of research or the research funding process. Even those measures specifically designed for research, like the new NSF broader impacts criterion, can develop politics around the articulation of the standard and the ability of funding agencies and peer reviewers to evaluate such articulations. Arguably, the role of the broader impacts criterion is to get researchers out of their internalist arguments and connect their research beyond the narrow (academic) laboratory—in effect, creating a different kind of research politics that includes users, stakeholders, and others, and not just readers of scientific papers. Whether this policy works and whether it comes at the cost of less funding for ultimately more important but immediately less beneficial science are questions for research.

Another political consequence of how research gets funded is secrecy. Secret processes related to weapons research, particularly nuclear weapons but also new security research at national laboratories and on some campuses, may have troubling consequences for the general advance of science, including the training of graduate students, as well as for democratic politics. But the trade-offs between secrecy and scientific advance are unclear. There are some kinds of research that societies might not fund unless they could be kept secret. The implications of science secrecy for a well-functioning democracy are similarly unclear and the consequences for greater democratization of research policy are uncertain.

Research policies create different kinds of politics in the global context as well, as knowledge is produced not only in laboratories across the globe but in institutions of civil society, including the media, advocacy groups, and indigenous groups. Institutionalizing different conclusions about the nature of knowledge, expertise, and credibility in different places makes a different politics, with characteristics that are not easily foreseen.

5. Policy

The literature distinguishes between two types of uncertainty: aleatory uncertainty, which results from natural complexity and randomness, and epistemic uncertainty, which results from shortcomings in knowledge and processes of and capacities for inquiry. The discussion above included consequences for people, programs, patrons, and politics that were unanticipated because of both types of uncertainty.

The participants at the Tucson workshop recognized the difficulty in engineering human institutions and the uncertain outcomes that can occur when such attempts are made. However, the group did not believe that uncertainty should become an excuse for inaction—especially because the future benefits of research are not forecast with any more precision or certainty than the future costs. Predictions about the impact of research are made all the time, but prediction is not really what the inquiry is about. We should be willing and able to examine how research policy interacts with other social institutions so the credit or blame is, appropriately, not placed on the shoulders of science alone.

Workshop participants found it troubling that programs for envisioning future policy and other social outcomes, such as the Office of Technology Assessment, have been cancelled. The ethical, legal, and social implications (ELSI) research that has gone along with genome research, and now

is a companion to nanotech research, has been important but arguably has only been partially successful and has not brought about a strong critical capacity within the community that studies research policy.

To summarize, a program to explore research policy as an agent of change needs to reduce epistemic uncertainty broadly across the dimensions of people, programs, patrons and politics discussed above.

D. Agenda setting

Research agendas are influenced by a wide variety of events, cultural trends, mass media framings of problems, and economic conditions. Because agendas foreshadow outcomes many groups attempt to set agendas for research policy. Usually they try to influence the federal government because they seek funding for research. Sometimes groups seek long-term funding in a general area (computer technology, biotechnology); at other times, they seek support for specific projects. Frequently, groups try to shift policy, as did a segment of the American business class that was against "dual use" (DoD/commercial) policies because they impeded U.S. global competitiveness. Biomedical policy provides numerous examples of different kinds of groups influencing and attempting to influence policy.

Among the types of organizations that try to shape federal policy are think tanks (e.g., Brookings Institution, American Enterprise Institute); "blue ribbon" commissions (such as the President's Council on Bioethics); political parties (the Democratic Leadership Council under Clinton); organizations of scientists (American Association for the Advancement of Science); lobbyists (from defense firms, from organizations seeking earmarks, from research universities); and a wide array of grassroots and social movements (Science for the People, anti-nuclear groups, anti-cloning groups, anti-globalization groups, pro-solar groups). The White House, through the Office of Science and Technology Policy, and a number of Congressional committees are involved in setting the research policy agenda, as are many executive branch agencies, including OMB, DoD, DoE, NASA, NIH, and NSF.

There are a number of studies of how such groups lobby or otherwise seek to influence research funding. The role of Congress in shaping the national agenda for research policy is, however, understudied. Generally, we know relatively little about the interactions of the different branches of the federal government in agenda setting for research policy. Understanding how various parts of the federal government work together is important, especially given the expansion of efforts to coordinate science across agencies, as the example of the National Nanotechnology Initiative dramatically demonstrates. Nor are there many studies of the interaction among various lobbying groups, think tanks, and commissions, or of how the work of multiple groups intersect with the federal government's many policy arms. Understanding the part these groups play in agenda setting for research policy becomes more important as science becomes ever more integral to our everyday lives.

A large number of groups are interested in science policy, at least in specific areas. A cursory search on the Internet yields many hundreds of non-profit groups and social movements with such concerns . The role of these groups, who stand outside bureaucratic understandings of the policy process, in agenda setting merits more attention. Although well-established organizations may

enjoy more power than grassroots organizations, social movements also influence agenda settings, though when and how is difficult to predict. It appears that grassroots and social movement groups can sometimes exercise what amounts to a "veto" on policy, as may have occurred in the case of nuclear energy. They are also capable of pushing investments in science, as evidenced by the apparent successes of some "disease lobbies." As public reaction to scientific developments (e.g., GMOs) assumes more importance, understanding the role of grass roots organizations and social movements becomes crucial.

Science policy researchers often see the most important agenda-setting issue as promoting funding for basic research. This focus misses many important impacts, such as the effect that research policies can have on universities and other research institutions. For example, the bipartisan competitiveness coalition in Congress that has operated since the 1980s passed legislation designed to make America more competitive in global markets. The Bayh-Dole Act, which was part of that legislation, was designed in large part to stimulate small businesses, which were seen as engines of economic recovery. Yet the Bayh-Dole Act had an enormous impact on research universities' capacity to develop intellectual property and perhaps inadvertently shifted them toward entrepreneurial research. As the U.S. economy becomes a knowledge-based economy, many policies aimed at promoting economic growth influence national research agendas. To understand better how research policy agendas take shape, RPAC research needs to use a broad lens, including not only legislation specifically aimed at the research system but also other laws that directly or indirectly influence research policy.

The states also participate in setting research policy agendas. Beginning in the 1980s, states pursued economic development programs that often had strong research components. In many cases, they sought to emulate Silicon Valley and the Route 128 beltway in Massachusetts, creating a synergy among universities and large and small businesses, stimulating technology clusters, and connecting local development to national and world markets. Many states promoted entrepreneurial research agendas that were more focused and tightly articulated with regional and national business needs than was the federal agenda. Although such cases as Silicon Valley and Route 128 have been studied as examples of successful regional centers of innovation, the processes by which state agendas take shape are not well understood. How state research policy agendas interact with federal government agendas in setting goals and distributing funds has received even less attention. Given that one of the purposes of research funding is to create new technology that will stimulate economic development, there is a great need to understand these complex agenda setting processes better.

E. Conclusion

The discussion at the meeting ranged widely. It can be grouped into the four categories identified above.

Under infrastructure, one main topic of discussion was the need for better data, more easily accessed. Another issue was the need for research program assessment. Participants recommended thematic conferences on the topics, to develop a community of scholars and, in the long run, a broader group of interested stakeholders. The conferences could help in training a next generation of scholars, also viewed to be quite important.

The discussion about beneficiaries identified patrons themselves as beneficiaries of the programs they support. It noted that universities are direct beneficiaries. General discourse highlights economic and other benefits, that need to be disaggregated so that scholars and stakeholders can identify which individuals and groups benefit, in which ways, from which programs undertaken by which organizations.

Similarly, research policy as an agent of change should have the goal of reducing epistemic uncertainty and identifying unintended consequences on people, groups, programs, and patrons. It can examine the relationship of politics to unintended consequences for all affected parties. Research policies themselves need examination in light of the unintended consequences they may have.

Workshop participants discussed issues of agenda setting for research policy. Many, many different groups are involved in this process. Understanding the parts that significant actors play is of major importance to addressing the needs and research questions identified in this report.

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