

### Introduction

Three years ago I participated – as did several at this meeting – in a workshop sponsored by NSF on “Research Policy as an Agent of Change.” Anticipating an “agents of change” program within the Human and Social Dynamics initiative, and influenced by the presence of strong contingents from both innovation studies and science and technology studies, the participants of the earlier workshop concluded that:

1. A focused effort to study research policy as an agent of change (RPAC) is urgently needed.
2. Studies of RPAC will require the use of diverse research methods informed by a range of disciplinary, interdisciplinary, and multidisciplinary perspectives.
3. NSF should explore ways to encourage research in this area.

I would like to frame my remarks as a reflection of the RPAC conclusions, in the context of the current discussions about, as an earlier document describes it, a “Science Metrics Initiative: Towards a Science of Science Policy” (SSP).<sup>1</sup> I’ll do my best to provide some perspective on the questions intended to spur discussion in this first panel, namely:

- What is science policy? What role does it play in national life?
- Is US science policy distinctive in content or process?
- How do differences in organizational, cultural, economic, social, political, informational and resource environments affect the development and implementation of science policy?

I conclude that we need a research program that I will call a “political economy of research policy” that is broader than SSP and more akin to RPAC, but that is well-oriented toward decision contexts, more akin to SSP than to RPAC.

### What is science policy? What role does it play in national life?

The first issue to note is that the RPAC group defined its intellectual space as “research policy” rather than “science policy.” As most of us recall, Harvey Brooks classically resolved the ambiguity in science policy by defining “policy for science” and “science in policy” as separate, albeit interacting, domains. “Research policy” appears to do away with that ambiguity by holding to one aspect of it only, as the RPAC report defines it as “a strategy for achieving developments of new knowledge, new forms of expertise, and new

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<sup>1</sup> I do this at the acknowledged risk of offending a host. I do not know who authored SSP -- the copy I received was without attribution – and I don’t even know if its distribution was authorized.

infrastructures.” The RPAC report, however, expands greatly upon this definition by looking to the vast array of actors, institutions, and strategies that are involved in knowledge, expertise, and infrastructure, e.g.:

- The array of substantive areas pertaining to public and private investment in research and development (R&D), including commercialization and technology transfer, the safe and ethical conduct of research, the organization of scientific activity and its reward system, etc.
- The activities of scientific advisory bodies and regulatory agencies, universities and hospitals, standard-setting organizations and professional bodies, courts and legislatures – all of which shape knowledge creation, diffusion, and use.
- The variety of institutions – across the sciences, the professions, administration, and politics (or what Don Price called the four “estates”), as well as intermediary or boundary organizations, manufacturers, venture capital, insurance and re-insurance, NGOs, media, civil society and social movements – that are involved in any aspect of knowledge creation, diffusion, and application.
- The range of mechanisms, from public budgets and other legislative action, to court rulings, non-state policies, patterns of practice, and the direct, indirect, or unintended consequences of any of these mechanisms on the knowledge enterprise.

The SSP document limits science policy to public and private investments in R&D – still narrower than RPAC’s research policy, which is itself really only half of science policy, canonically defined.<sup>2</sup>

RPAC recognizes that “[s]cience and technology are integral to major social, political, economic, and environmental transformations, with significant implications at local, national, and global scales.” In search of greater clarity about this integral relationship, the earlier group argued that “RPAC should encompass studies that treat research policy as an independent variable and studies that treat it as a dependent variable.” The SSP document restricts the scope of interest entirely to the economic, articulating its major goal “to reach a point where the nation’s public and private sectors are able to evaluate reliably the returns they have received from past research and development (R&D) investments in science and engineering and to forecast, within tolerable margins of error, likely returns from future investments.” It thereby treats research policy as an unproblematic precursor to the more important and uni-dimensional “investment,” that is, the budget for R&D – rendering science policy analysis almost exclusively a budgetary tool rather than, say, a technology assessment capability.

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<sup>2</sup> One might also note that some of the most important and creative areas of science policy research of late have in fact been those dedicated to understanding how to do better with the research, science, and technology that we have and are making, e.g., the Decision-making Under Uncertainty program and the Center for Nanotechnology in Society, that is, with what might be called “science for science in policy.”

Although both RPAC and SSP share an interest in science metrics, RPAC’s vision includes not only data about investments and returns, but also historical and policy archives and, importantly, “better measures of the effectiveness of research policy” that are not necessarily limited to return on investment. Indeed, the effectiveness of research policy requires an understanding of outcomes that are connected with the goals of the research itself – which, for better or for worse, may not include yielding an economic return. For example, research policy may have as a goal military supremacy, or social connectivity, outcomes that are problematic to measure in the investment frame, or reduced child mortality or a smaller gap between rich and poor, outcomes for which the economic measure is somewhat beside the point.

SSP does, however, envision an

integrated approach [requiring the] understanding and assessment of the underpinnings and ramifications of innovation among individuals, organizations, and societies. It will require identifying the stages and feedback mechanisms that influence R&D directions, processes, products and outcomes, and their relationships to individual, economic, and social well-being.

Here SSP seems to envision something that I encouraged RPAC to consider, what I called a “political economy of research policy” that would take into account the full cycles of transformations that create public and private values from knowledge socio-political activity, and back again. But, according to the timeline provided in the SSP document, it is not until the third year of work that the program would grapple with a “fundamental understanding of invention and innovation as psychological and social processes.” This framing thus treats the non-economic aspects of innovation as secondary to the economic ones – either because they are less or important or because they may be more difficult to analyze. While the latter may be true, the analysis of the non-economic aspects will neither become more tractable nor become competitive with the analysis of the economic aspects by postponing research on it.

### **Is US science policy distinctive in content or process?**

Both RPAC and SSP recognize a global and regional perspective on science policy, in addition to the national one on which they focus most attention. SSP envisions US science policy as deeply embedded in an international system, acknowledging that “it will be advantageous to approach this undertaking in light of efforts in other nations and international agencies (such as OECD) to deal with similar concerns and with an eye to the globalization of science and technology.” Similarly, RPAC recommends significant “comparative studies of research policy” as well as attention to transnational organizations like WHO and IPCC.

Neither agenda speaks to what is or may be distinctive about the content or process of science policy in the US per se. But to the extent that innovation is not simply the product of the inexorable accumulation of technical know-how and the impersonal operation of economic laws – that it involves historical factors and path dependencies such as the availability of particular resources at particular historical moments, cultural factors such as attitudes toward risk or food or religion, developmental factors such as levels of education and styles of governance, institutional factors such as the independence of the university sector or the strength of intellectual property laws, or the relative degree of trust in or alienation from governing decisions by the populace – the RPAC agenda is a much more promising one for bringing out national distinctions that might lend insight to policy making.

Despite the great intellectual ambitions of RPAC and SSP, neither agenda is wholly capable of managing what might be noted as one of the greatest distinctions in US policymaking, particularly with respect to science but apparent in other areas: its relative indifference to the expertise institutionalized in public bureaucracies rather than that offered by the plural groups of civil society. This critique is not limited to any alleged troubles in the current administration, but rather to a broad phenomenon that embraces many characteristics of the US system including the proliferation of think tanks, most with partisan affiliations, since the 1970s, the decline of offices of analysis in public bureaucracies over much the same period, the stable level of legislative staffing over recent decades (after a decline) despite the arguably more complicated and technology-laden legislative agenda, and the use of the adversarial system for a great share of what amounts to technological choice in this country. Whether a new research agenda will be shaped like RPAC or SSP or something else entirely, where will this information go? And can the agenda be structured to be maximally useful in a political system that is minimally interested?

It is likely that SSP is somewhat better poised than RPAC in this regard because, limiting itself largely to economic analysis within an investment framework, it hews more closely to the language of its potential patrons and, moreover, is more tightly linked with the kinds of explicit decisions that they are already making, in institutional contexts that are already clearly defined, e.g., the federal budget process. Although we lack, as Frank Baumgartner notes in his RPAC essay, a overarching research policy, we do have both a budget for research and a multitude of uncoordinated research policies. There are policy contexts within which RPAC analysis would certainly be useful, and perhaps even more significant for societal outcomes. But these contexts are more likely to be involved in agenda setting and problem framing, and therefore less likely to be institutionalized than the budget allocation issues. They are also more likely to be decentralized decisions about how to manage inquiry and knowledge-based innovation, and less likely to be centralized decisions about large-scale resource allocation. If, however, as the SSP document hints by imagining research centers dedicated to analyzing the return on investment in particular disciplines, the goal

is not merely to use the economic analysis for large-scale budget priorities but for more micro-level decisions, then one might quite seriously worry that the ambitions of the two approaches would in fact be seriously in conflict and not potentially complementary.

### **How do differences in [various contextual] environments affect the development and implementation of science policy?**

As one might infer from my remarks, I believe this question to be a critical one – not for science policy per se, but for knowledge-based innovation, and thus for science policy. Because the inputs to knowledge-based innovation are much more than a budget, and because the outputs from it, not to mention the societal outcomes – intended or otherwise – are much more than economic return, creating an evaluation scheme that focuses on only economic return threatens to displace goals toward generating only economic returns.

Recognizing, however, that these different contextual environments affect science and thus, by necessity, science policy is not the same as being able to turn this knowledge to instrumental use for science policy to guide science to being a more integral and more productive enterprise. This leads me back to my RPAC essay, which attempted to articulate a variety of influences – beyond economic returns – that could be traced to research policy:

- The organization and behavior of sciences, both through the creation of funding opportunities and programs as well as through the consequences of developing new research tools and technologies.
- The delivery of innovative goods and services – both those that are easily priced and thus measured and those that are not – as new knowledge is organized, transferred, absorbed, applied, and developed.
- The organization of public and private institutions around the performance of research.
- The changes among larger-order national and global systems through the rise and fall of industries, innovations in the technologies of warfare, increasing understanding of global environmental change and vulnerabilities, the ability to intervene in human health and reproduction, etc.

And, most importantly, the influence of these changes on the quality of life people across the country and around the world.

Although there are research agendas on most or all of these topics, my sense is that such research does not complete a full political-economic cycle that would create the most value from the research. For example, as little as we know about the dynamics of how researchers “follow the money,” we probably understand even less about how that behavior cycles through scientific productivity, innovation, and demand for institutional change in the organization of research funding. As much as we know about the role of university-based research in

regional economic development, we know far less and in a less systematic way about the influence of that role on political processes and outcomes in such regions and the subsequent changes on universities priorities and internal operations. Even if we can understand how research institutions respond to the structure of and incentives contained in research policy, we do not fully grasp how they react to the consequences of the knowledge-based innovations they then produce. To the extent that we include global perspectives in the research agenda on research policy, we still face the challenge of fully accommodating the diversity of global contexts into our analysis and the feedback from global conditions in local politics.

I hope that an initiative to bolster science policy analysis for science policy decision making would take into account the diversity of questions and approaches identified by the RPAC agenda, even while integrating them with the attentiveness to the decision context expressed in SSP.