Office of Science and Technology Policy (OSTP)
Improving Performance & Management of Federally Sponsored Research
UC Davis Input

Subcommittee on Research Business Models

Federal Register Notice Comments requested

Question F. Research Support. How can public funding mechanisms and policies encourage or discourage innovative approaches to research? Does the current process for research funding encourage or discourage innovative research? How do support mechanisms influence the mix of investigators supported (e.g. principal investigators, research scientists, postdoctoral scholars, graduate students, or technicians): How can changes in the conduct of science and engineering necessitate modified funding models? Are data available to help decide these questions?

Policy/Encourage innovative Approaches to Research
We recommend that the Federal Demonstration Partnership (FDP) continue to be expanded and enhanced to enroll more institutions and heighten the visibility of this valuable initiative. FDP is both a policy tool and delivery mechanism that has streamlined the efficiency of sponsored research delivery by standardizing terms and conditions across Federal agencies, simplifying the prior approval process, and streamlining the award distribution process. In summary, FDP has made federally sponsored research more accessible to the researcher and easier to manage for the administrator.

Mechanisms/Encourage Innovative Approaches to Research
We recommend that electronic proposal and progress report submission systems continue to be developed and, most importantly, standardized as much as possible. The NSF Fastlane system is the prime example of an efficient electronic submission system; it is accessible to principal investigators, staff support personnel, and administrators. We must caution against the development of numerous, competing electronic submissions systems that may create significant confusion and jeopardize timely submission.

Mix of Investigators Supported
The FDP and electronic submissions systems have encouraged researchers from various fields, backgrounds and institutions to pursue collaborative sponsored research because these systems make the administrative aspect of research uniform. Expansion of successful electronic systems (e.g., NSF FastLane) to other sponsoring agencies should enhance these types of collaborations. Another potential way to encourage collaboration of a broader mix of researchers is to improve upon centralized repositories that list available funding opportunities. Heightening the visibility of Requests for Proposals and Applications will encourage those who do not have an established relationship with program officers from various funding agencies to be exposed to, and to apply for additional funding opportunities. At UC Davis, not unlike similarly situated institutions, the research funding is largely skewed toward those researchers in the physical and biological sciences with a long history of extramurally funded projects. Creating a highly visible, centralized repository of funding opportunities may encourage those in the social sciences, as well as the less experienced researchers to apply for federal funds.

Data to Address the Above Issues
There are many sources of data available to illustrate the impact of the FDP and NSF Fastlane. Both the volume and dollar amounts of research awards by Federal agencies could be tabulated to measure the extent to which these initiatives have permeated the research community.

A main objective for science and technology policy should be to help eliminate disciplinary boundaries that have evolved over centuries of academic tradition; contemporary complex research efforts in, for example, nanotechnology, biotechnology, and biomedical engineering require scientists in different disciplines to work together. Science and technology policy can define the structure and "make-up" of the 21st-century university, where cross-disciplinary research will be the standard mode for advancement in many areas of scientific inquiry in science and engineering fields.

The NSF Science and Technology Center (STC) and Engineering Research Center (ERC) programs are centered on the idea of conducting research (and complementary educational efforts) in a collaborative Center setting. Typically, diverse faculty teams and collaborators from industry and national laboratories from multiple disciplines work jointly with graduate students, post-docs, and researchers to investigate inherently complicated problems. Research Center environments emphasize co-supervision of students and researchers, active visitors and exchange programs and, typically, application-driven research. Science and technology policy should consider the various benefits that arise from such Center-based efforts, and increase further funding for research Centers, especially in society-relevant areas.

Research Center-based efforts are becoming increasingly important components of the research and education focuses of science and engineering departments. Recognizing this trend, science and technology policy must take into consideration that larger research centers are more likely to be owned by a university at large, where Centers report to a central oversight unit, not just one department. Considering the desired broad definition of Center-based research, in many cases maximal research prosperity can be achieved only if reporting and oversight issues are treated centrally, and not, for example, within the boundaries of a specific college or department. We discuss some examples in the following paragraphs.

Computational approaches have become increasingly important over the past two decades to solve society-relevant problems. Computational science and engineering (CSE) is now an established scientific discipline, which is conducted ideally in close symbiotic collaborations involving scientists from applied mathematics, computer science, and others in the driving applications areas such as physics, chemistry, or biology. CSE is a field driven by the needs of the scientific research community and applications throughout science and engineering disciplines. Strong ties and interactions between users and developers of computational technology are crucial for the success of CSE in the future. Academic boundary conditions must enable and support multi-disciplinary research collaborations, coupled with desirable curricular innovations for the training of next-generation students in relevant CSE approaches. In the context of CSE, for example, science and technology policy can catalyze the desirable stronger integration of science and engineering research and graduate education efforts by further increasing emphasis on multi-disciplinary, multi-investigator, and even multi-institutional funding opportunities.

Large-scale computing-centered research requires substantial investments in basic supporting infrastructure, including costs for maintenance and administrative staff. Academic institutions are typically not in a position to support large-scale multi-investigator Center-like efforts with sufficient base support, concerning equipment and administrative needs. It is desirable to increase the number of funding mechanisms and programs that would provide a relatively larger number academic institutions access to funding dedicated to supporting infrastructure needs of campus-wide, cross-disciplinary computing-centered efforts.

Traditional funding policy, and academic tradition, assumes that scientists conduct their research in either the theory-simulation or the experimental-observational setting. Science and technology policy can foster the highly desirable integration of research efforts in these still rather separated settings. The driving objective behind more integrative efforts should be to make possible a much more effective, team-oriented process to gain new fundamental scientific insight and transfer this insight quickly into technological domains.

Scientific disciplines that just a few years ago were rather "data-poor" have become, and will become even more so in the future, "data-rich." Advances in ultra-high-resolution imaging, sensor-network technology, and increasing supercomputing simulation power are creating data sets so large that individual scientists no longer are able to fully mine the generated data. To ensure that scientific data sets are explored fully it is imperative to share massive data sets with the scientific community at large, and to establish funding and collaborative research mechanisms supporting the data sharing over high-speed networks. Science and technology policy must fully recognize the basic paradigm shift affecting the very essence of the discovery and design process in science, engineering, and medicine; funding policy must recognize the need for a "digital cyber-infrastructure" that scientists will have to rely on to effectively utilize vast, rapidly expanding digital data repositories. It is paramount to recognize that the needed technology has to be defined, implemented, and tested in close collaborations involving domain scientists and technologists.

Scientific data management - including data formats, data storage, data conversion, data transfer, data-query technology, etc. – is becoming increasingly important. Formerly disparate sub-fields in science or engineering domains begin to integrate, and thus diverse data sets must be combined for collaborative scientific discovery and engineering. Integrated "data science" technology is in its infancy, and the gap between our ability to generate multiple data sets describing a highly complicated phenomenon and our access to appropriate data analysis tools is widening. Revolutionary progress is needed in distributed and network-supported scientific database and information systems technology to allow the scientific community to analyze data repositories more comprehensively.

Especially in engineering and high-technology disciplines, multiple system development efforts are ongoing concurrently and competitively, with little emphasis placed on "harvesting" the individual results for the potential user community at large, and with hardly any efforts dedicated to integrating partial results obtained form diverse efforts going on in parallel at multiple institutions. Research in computer and computational science and engineering in academia is typically driven by the need of developing a system prototype that suffices to demonstrate an idea in a conference or journal publication; centralized efforts to utilize and integrate the vast amounts of prototype software hardly exists. Science and technology policy can play a significant role in fostering the establishment of "integration centers" whose mission would be to identify and integrate the latest and most powerful in computer and computational science and engineering technology. Ideally, such centers would be co-funded and co-administered by industry partners or consortia, with a main objective being rapid technology transfer into the private sector.

Question G. Multidisciplinary/collaborative research. Are any funding organizations, either inside or outside of government, employing funding mechanisms or strategies that are particularly effective in encouraging multidisciplinary work, collaborative activities, and other innovative approaches? Are there any data available relevant to these questions?

There exists an increased need to communicate scientific and technological capabilities more quickly and more effectively to the (potential) user community, especially the industrial sector. In general, individual scientists and research engineers in academia cannot be expected to be aware of the needs of and trends in all industrial applications directly related to their research domains.

Effective "knowledge and technology transfer" is needed. Science and technology policy can support this goal by mandating and supporting at a much-increased level technology transfer-driven components in federally funded research. Novel mechanisms must be defined that will allow scientists and engineers from academia to communicate findings to non-traditional groups, especially the industrial and policy sectors. For example, designated conference centers or national laboratories could serve the purpose of communicating our scientists' latest findings to the broad potential user communities.

<u>NSF Collaborative Proposal Mechanisms</u> - NSF's collaborative research opportunities and Fastlane system make the collaborative submission process simple. Prior to linking proposals from various institutions for a collaborative project, NSF requires that the approval of the relevant program officer be secured. Once such approval is granted, the collaborating institutions are allowed to submit their respective proposals, which are electronically linked through the Fastlane system. The collaborating institutions each receive separate research funds, i.e., no subcontracting is involving. However the projects remain programmatically linked. Under this system, the administrative burden is significantly lighter for the participating institutions, while the investigators/institutions clearly benefit from the collaboration.

<u>University of California's Industry-University Collaborative Research Program</u> - This UC program invites the researcher to find an industry partner to sponsor a research project. If selected, the program, using State of California funds, will match (1:2) the industry partner's contribution to the direct costs of the project. The goal is for the university is to partner with industry to facilitate research and potentially commercialize any technology that may arise from the research results.

<u>University of California's MEXUS Program</u> - This UC program invites the researcher to find a Mexican researcher to partner on a collaborative project. If the project is selected, the MEXUS program issues an award to the Mexican and UC institution, separately, with common and uncomplicated terms and condition. Similar to the NSF Collaborative projects, the MEXUS program provides administrative ease, i.e., no subcontracting and straightforward terms and conditions, and facilitates collaboration.

<u>Data to Address this Issue</u>
The above programs have volume and dollar totals that can be used to summarize the impact of these mechanisms on the research community.

Question H. Research Infrastructure. What information is available to examine policies at the Federal, State, local or institutional level that affect research infrastructure and the costs of building, maintaining and/or operating the research infrastructure' What factors influence performers' investments in research infrastructure? What data are available to demonstrate that? What information is available on the mix of sources used to finance research infrastructure?

Research infrastructure policies vary at the Federal, State, local and institutional level; thus we have no comment on this question.