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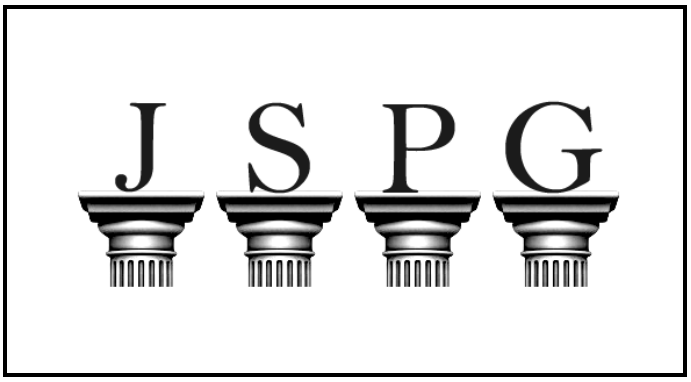

POLICY ANALYSIS:

ADVANCEMENT OF THE MULTIDISCIPLINARY RESEARCH PARADIGM VIA FACILITIES & ADMINSITRATION COSTS AND COST RECOVERY INCENTIVES

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Executive Summary

One prominent debate over the federal government's investment in U.S. university research revolves around the following: should federal agencies contribute to research Facilities and Administration (F&A) costs? If so, how much should the agencies reimburse universities? How should F&A costs be computed and how should the distribution of the funds be evaluated? The robust partnership between universities and the federal government has resulted in significant revisions for many of the principles and guidelines regarding F&A costs. Moreover, attitudes regarding those revisions have varied. While federal agencies have been set on capping their funds using principles that are directed towards enhancing the contribution of the universities to the research costs, there have been continuous efforts by universities to increase cost recovery without depleting the federal research budget.

Academic and university associations have been lobbying for more cost recovery mainly due to self-interested expansion of their own research enterprise; however, the federal government has the potential to capitalize on extensive cost recovery in the form of infrastructure expansion, in terms of facilities, administration and virtual services, and tools. Using the measures of national economic and social returns, in addition to the re-orientation of the national research capacity towards national goals, provides promising incentives to reform the federal cost recovery methods.

Research universities, industry and the federal government are beginning to adopt a new research paradigm that emphasizes horizontal integration via multidisciplinary collaborations, and vertical integration via technology transfer translation. Specialized infrastructure with open environments conducive to collaborative work and high-caliber equipment, services, and tools

are the foundation of this new research paradigm. Accordingly, the federal government should champion such infrastructure investments at research universities. However, university institutions are currently suffering from financial roadblocks due to certain cost recovery policies, federal laws, state laws, and institution-specific policies.

While federal multidisciplinary research funding has been successful in fostering collaborative research and subsidizing its direct costs, it typically does not account for the high F&A capital investments, and does not support the key infrastructural characteristics needed to excel at collaborative research. Therefore, additional financial cost recovery incentives can and should provide further endorsements and compensations to foster multidisciplinary research. In return, the research capacity of the U.S. can expand and yield higher research output, economic return, social return and progress toward national scientific and technologic goals.

History of Federal Policies Regarding F&A Costs

The costs associated with undertaking research at a university can be categorized into either *direct costs* or *indirect costs*. Direct costs, such as research personnel salaries, equipment, materials, or models necessary to undertake the apparent project, are assigned to a specific research project with a high degree of accuracy. However, *indirect costs*—also called Facilities & Administration (F&A) costs—are relatively more difficult to assign or affiliate with a certain project. They are costs incurred from broader university objectives, which complement other activities, such as scholarship and education, infrastructure construction and maintenance, and university services useful for research conduction. Examples of F&A costs include libraries and administrative salaries and costs.

Distinction between federal funding for direct versus F&A costs became exigent as the federal government became the dominant entity to fund university research in the early 20th

century. Yet, the issue of F&A cost reimbursement has remained under federal scrutiny most notably due to the varying guidelines amongst federal funding institutions and the late 1980s publicized incidents of alleged overcharges for F&A expenses. In response, the federal government has formulated policies to address funding concerns while maintaining their dependence on university research for two major goals (Neal, Smith, & McCormick, 2008, p. 104):

1. To reach national objectives, such as homeland security, national defense, energy, environment, health and agricultural solutions.
2. To encourage and sponsor basic theoretical research that does not seek potential uses for its findings, but serves purely for the advancement of knowledge.

In this time, the federal government pursued several initiatives that signified their strong interest in science and technology (Nelson, 2010). The establishment and success of several federal agencies—including those based on military, agricultural, and health innovations, which sustain the national defense and general welfare of the nation—further anchor the roots of science policy in the federal government. With the culminating interest in science and its contributions to national goals, the federal government sought robust partnerships with research universities across the nation, given that the science community provided valuable scientific talent and scholarship, and demonstrated significant scientific output. Research taking place in university settings during World War II allowed for the federal government to initiate a massive expansion in Research and Development (R&D) via large increases in the amount of federal funds flowing to universities.

The concept is simple: the federal government provides funds for university R&D to fulfill national objectives, while giving scientists as much flexibility as possible to pursue personal interests in the realm of basic research or beyond. The potential therefore is unimaginable. The expansion has triggered the establishment of more Science and Technology (S&T) oriented federal agencies, such as the National Science Foundation (NSF), the Atomic Energy Commission, and the Office of Naval Research (ONR). Ever since, this intricate partnership has resulted in more structured funding for university research. Prior to 1958, each federal research-funding agency developed and maintained its own cost recovery measures and guidelines. In fact, in 1947, the ONR conducted its first principles to determine F&A cost calculations, under the name "Blue Book"(Goldman et al., 2000).

In an effort to streamline the F&A costs eligibility and calculations, the 1958 issuance of the Circular A-21, Cost Principles for Educational Institutions, by the Office of Management and Budget (OMB) signified the first attempt to establish government-wide cost recovery principles based on a revised ONR Blue Book. Circular A-21 was issued to be "applicable to research and development grants, contracts, and other funding agreements between the federal government and education institutions" (Kenzo, 1995, p.6). It defined direct and F&A costs and set standards for accountability, documentation, and consistency. The item has been revised multiple times since its first issue with its most recent edition released in May of 2004. Several of the major and controversial revisions and their subsequent implications affected university research and scientific output. Most notably, the most controversial revisions have resulted from inconsistencies in cost allocation practices and concerns about the abuse of funds. Nevertheless, these revisions have effectively limited the amount of F&A costs that can be recovered from

federal research grants, and forced universities to subsidize a significant amount of these costs themselves which has inadvertently affected either their education or research performance.

The Impact of Circular A-21 Revisions

Circular A-21 lays out eligibility and compensation guidelines for all federally funded university research. Since 1958, the cap has been incrementally adjusted to accommodate the inflation of the currency and the expanding research capacities of both small and large institutions. However, as of 2004 it offers simplified procedures of F&A cost calculation for small institutions with direct costs that do not exceed $10 million dollars, while maintaining a more scrutinized and lengthy process for institutions with direct costs exceeding $10 million dollars (Goldman et al., 2000). Additionally, Circular A-21 underwent various revisions that generally reflect one of two changes:

1. Revisions to principles and guidelines, in particular to establish new allowances or limit and/or cap certain costs, provide clarifications for existent costs and identify documentation necessary to apply for and receive reimbursements.
2. Procedural refinements were implemented both to cut down the federal administrative costs attributable to the process of appropriations, distribution and evaluations, and to simplify the university administrative process in evaluating F&A costs.

During the first change in 1979, OMB established the Modified Total Direct Costs (MTDC) as the basis for calculating F&A costs. In 1991, administrative costs were capped at 26 percent. In addition, certain guidelines were set to prevent loopholes that can allow for the misuse of funds, such as cost recovery for extravagant reasons. Some costs were excluded, such

as alcoholic beverages, entertainment, alumni activities, housing and personal expenses of officers, defense and prosecution of criminal and civil proceedings, claims, appeals, patents infringements, and trustee's travel (Goldman et al., 2000). The latter of the two changes took place in 1982 and included revisions that eased effort-reporting requirements to cover only work funded by the federal government, rather than all research, teaching, and administration. In addition, the reports were allowed to be filled out by persons other than the researchers. Therefore, those revisions improved the efficiency of the whole process.

Major revisions in Circular A-21 have the potential to yield significant impact on university research costs, while minor changes are nominal. For example, since the first full year the administrative cap was in effect, negotiated administrative rates have remained constant because universities decided not to expand their administrative base (Goldman et al., 2000). In addition, the increase in depreciation and use allowance rates for buildings and equipment (6 percent in 1988 to 9 percent in 1999) has been offset by reductions in operations and maintenance rates. As noted above, those effects can be constraining to the research capacity of universities. In contrast, minor revisions in Circular A-21 have not been shown to have a significant impact on universities. For example, in 1996, the threshold for capitalizing on equipment was raised tenfold in hopes that it would reduce auditing costs by eliminating the need to track small items and low-cost equipment; however, no effects due to the change were noted. In addition, no effects were observed due to utility cost adjustments.

The *Analysis of Facilities and Administrative Costs at Universities* (AFACU), published by the Office of Science and Technology (OSTP) in 2000, provided a detailed look on these revisions "to incorporate numerous measures to contain F&A costs, promote efficiency, improve equity, and minimize unexplained variations in rates across institutions" (p. 15). This served as a

basis for additional options to reduce or control the rate of growth of federal indirect reimbursements rates. It suggested the re-establishment of newer models of those revisions given that they have already proven successful. The General Accounting Office (GAO), in the AFACU report, estimated that the revision to establish an administrative cap in 1991 resulted in annual savings of $104 million. The report states that "[revisions] have streamlined and improved the consistency of the F&A rate determination process, and have reduced the variances of rates between institutions. Federal agencies used F&A savings to fund more research projects" (OSTP, 2000, p.15). Furthermore, those revisions have raised accountability measures on both the government and institutions, which stands in response to concerns by Congress due to several publicized cases of misuse of F&A cost recovery funds. In the meantime, the Federal Accounting Standards Advisory Board issued a set of cost accounting standards for all federal activities as mandated by the Government Performance and Results Act (GRPA) released in 1993. As a result, the OMB has been required to disclose cost accounting practices, which in turn prompted it to revise Circular A-21 in 1996. This change required federally-funded research institutions to disclose cost accounting practices (Strategisys, 2010).

Despite these revisions, the most relevant piece of information by the AFACU is the recommendation on F&A payment reduction options. The report stresses that while several options exist that would cut down the recovery costs, these costs would simply be shifted from the federal government to the partnering institutions. In one aforementioned example, use allowance and depreciation methodology changes increased rates for buildings and equipment, yet reduced operations and maintenance rates. In essence, the costs were shifted within the university budget. The consequences of shifting more burdens within an institution or between an institution and federal agencies can be tremendous.

The Impact of Underrecovery

Currently, due to several federal and state laws, statutes, and institute-specific policies, institutes do not receive full recovery costs: the federal government pays between 70 and 90 percent of the total negotiated amount of F&A costs. Interestingly, the unreimbursed facilities and administrative costs represent about 20 percent of the university funds devoted to research, which was estimated to be about $1.2 billion in 2001. The other 80 percent of these funds supported the following two components: private institution R&D funds, and direct cost sharing of some projects, particularly by subsidizing research faculty time. The direct cost sharing can be either mandatory or voluntary by the funded institution, where higher cost sharing increases the institution's chances of securing a grant. As an example of the former, NSF has a statutory requirement that universities contribute at the minimum one percent of a total project cost. The NSF estimates that the funds are divided roughly equally between private institution funds and the mandatory and voluntary direct cost sharing (Goldman et al., 2000).

In summary, Circular A-21 has been revised to ease the overall rates determination and reimbursement process and to standardize the principles that guide F&A costs at university institutions. There are multiple revisions that have successfully reduced the F&A costs from the federal government budget. Nevertheless, these revisions have consequently shifted the burden to the research institutions that end up subsidizing the recovery costs rates cuts. Furthermore, the cuts due to other federal, state, and local laws may constrict their F&A cost recovery, or impose direct and F&A costs sharing with the federal government. Those additional costs can result in lowering the research performance of a university, lowering spending for education, or increasing tuition rates to compensate for the reduced F&A recovery costs.

Therefore, the F&A cost reductions negatively affect both the economic return and social return of universities to the general public. It is not in the best interest of the federal government to continue this trend of F&A cost reduction. Rather, the federal government should adopt alternatives that bolster the economic, scientific, and social return without being cost-ineffective by providing additional, yet conditional, F&A cost recovery options. Universities should have more access to F&A costs as long as they are consumed or jointly consumed on research projects that address national goals, or advance the basic research foundation.

A Cost-Effective Recommendation to Increase F&A Cost Reimbursements

Circular A-21 revisions have reduced the federal contribution to F&A costs of federally-funded university research. However, this reduction has shifted the F&A costs underrecovery burden to the budget of the funded institutions, inadvertently either affecting the performance of their education or research enterprise. These financial demands further exasperate the situation by discouraging universities from investing in innovative research ventures, such as multi-disciplinary research.

The government decreases its F&A cost contribution to control its financial budget carefully without disrupting the scientific and technological output of its R&D enterprises. On the contrary, it would be appropriate to enhance the federal F&A costs contribution for projects that serve as a catalyst for the U.S. scientific output, which is typically accompanied with national economic and social pay-offs. This report recommends additional conditional cost recovery for investments in research infrastructure, in particular facilities, administration, virtual tools, and cyberinfrastructure. The government can intervene in fostering multidisciplinary research efforts using cost recovery incentives which have the potential for significant national and economic pay-off in the long term.

Government-based Innovation Clusters

The first successful surge of multidisciplinary research hubs was established to assist the building of the atomic bomb during World War II. The Manhattan project began as a small research project, but expanded into an interdisciplinary effort that brought together 130,000 personnel, scientists and engineers, under a budget of $2 billion (Hughes, 1983, p.9). It established several sites around the nation, which are now the model of our current national laboratories, and multidisciplinary research centers for universities and industry. The extensive nature of those research centers has proven successful and hence formed the basis for several partnerships, upon which the federal government contracts university or industry partners to oversee their facilities.

Post-Sputnik panic within the scientific community has yielded the inception of a new research laboratory model, the Defense Advanced Research Projects Agency (DARPA). Its mission has been to sustain military and technological advances to avoid another Sputnik-like surprise. To reach its mission, DARPA has adopted characteristics such as a flat hierarchy of small, flexible, talented, and multidisciplinary staff (Bonvillian, 2006). It has focused on project-based assignments, which allows for individual projects that coalesce into a collective goal via ongoing collaborations. Since its inception in 1958, the DARPA model has been replicated in a number of federal agencies, most notably by Department of Homeland Security, which has established Homeland Security Advanced Research Projects Agency (HSARPA), and for non-defense goals by the Department of Energy (DOE) through the recent Energy Innovation Hubs and by NSF through the Cyber-Enabled Discovery and Innovation program.

Energy Innovation Hubs are one of the most recent attempts to reform our current national energy policy via a strategic increase in the currently inadequate energy R&D efforts

(Nemet, 2006). As environmental, geopolitical and macroeconomic concerns are increasing, the U.S. has become more reliant on natural gas and fossil fuels. Current R&D funding is not sufficient to deploy alternative energy sources and reverse the growing dependence on conventional energy source, and accordingly the GAO has recommended that Congress focus R&D funding on advanced energy technologies (Wells, 2006).

Those innovation hubs uphold a bold research paradigm that emphasizes tools and infrastructure that facilitate collaborations. The current shortcomings of federal R&D are worsened by an obsolete research paradigm which depends on labs that are isolated from the marketplace and are too focused on use-inspired and industrial research targeted at new energy technologies and processes. Energy Innovation Hubs aim to transform and expand energy research by celebrating collaborative basic and applied research that encourages a strong bond to the marketplace via an intricate web of tech transfer and policy specialists.

Despite the differences in DARPA and the Energy Innovation Hub research models, they both value multidisciplinary research that is aimed to solve and advance national objectives. Those models of "innovation hubs" are immensely dependent on the proper infrastructure, which are designed, built, and administrated in a manner conducive to multidisciplinary collaborations. Those facilities are equipped with lab space unique to the institution's objectives, conducive of a multidisciplinary research environment, and integrated with easy and quick tech transfer solutions.

University-based Innovation Clusters

As federal intramural "innovation hubs" demonstrated incredible gains of scientific output in both basic and applied research, universities further enhanced the multidisciplinary paradigm and implemented it widely throughout their campuses. The first generation of

university research was a linear process that began with theoretical research by scientists, and ended with innovative applications by engineers. The second generation was distinguished with the engagement of industry in university research, significantly fueled by the passage of the Bayh-Dole Act of 1980. The third generation began to witness research-entrepreneurial university faculty, however, it devaluated the curiosity-driven basic research and focused on the commercially-driven user-inspired research (Forrest, 2010).

In the 1990's, the fourth generation of multidisciplinary research was influenced by the competitive atmosphere of globalization and commercialization which has degraded basic research to a lower priority. To accommodate those driving forces of commercialization, the research community is establishing close partnerships involving academics in different disciplines and institutions along with industry and government. Dr. Stephen R. Forrest, Vice President of Research at the University of Michigan, states "The 4th generation of research will be defined by creative and dynamic partnerships that come together to solve the most complex problems facing humankind. And when the immediate problem is solved, the team is dissolved, a new team forms with a different set of participants around new challenges" (2010).

The recent University of Michigan acquisition of a local Pfizer pharmaceutical complex and notable performance of the Biomedical Sciences Research Building (BSRB) are ideal models of university-based facilities utilized to enhance multidisciplinary approaches as the prime objective of the facilities. These facilities are based on research paradigms indirectly adopted from DARPA and e-DIIs. The North Campus Research Complex (NCRC), previously the Ann Arbor Pfizer Complex, aims to accelerate scientific progress on the "interdisciplinary axis and discovery-to-delivery axis." Dr. Forrest coined it as an entry into the "4th generation" of federal government-university relationship (Forrest, 2010). The NCRC campus consists of

multiple research technology clusters, which have been identified by medical school faculty as strategic interests. In addition, the campus houses an incubator space and technology transfer teams in an effort to counter the "valley of death", the transition phase from R&D to the market (U of Michigan report, 1 April 2010). The NCRC acquisition was influenced by the incredible gains of the BSRB, where space was planned around scientific themes within an open environment to encourage collaboration and innovation rather than the traditional department model. Dr. Steven Kunkel, co-director of general pathology at the time, reiterates, "Research now is, instead of silos, more horizontal. We really depend on a lot of different disciplines to conduct our research," Kunkel said. "Just the design of the building is very, very conducive to collaborate, interdisciplinary research just because we're physically right next to each other" (Borney, 2010).

This trend of “4th generation” research capable facilities has been surging across the nation during the last decade. University institutions are one of the frontier leaders in this naturally-guided campaign as noted by newly built facilities at University of Kansas, University of Washington, Texas Tech University, Stanford University, Cornell University, and Arizona State University to name a few. The federal government has been a staunch supporter of multidisciplinary research as is evident by several initiatives such as the Department of Defense Multidisciplinary University Research Initiatives (MURI), which supports university teams that rely on cross-fertilization ideas to transform basic research findings to practical applications (U.S. Naval Research Lab, 2010.). However, financial and sociotechnical hurdles still remain which hinder the advancement of multidisciplinary research.

Financial Incentives for Multidisciplinary Research Infrastructure

The multidisciplinary research paradigm faces several obstacles but financial incentives in the form of higher F&A cost recovery can empower universities to overcome those difficulties. Federal multidisciplinary research grants have successfully fostered collaboration amongst researchers, scientists, and engineers; however, institutional cost-specific practices and infrastructure-specific criteria for the proximity and ease of communication between those collaborators have been major barriers for the proliferation of the multidisciplinary paradigm. Collaborative research requires large, high-tech facilities, and specialized administration and maintenance capabilities for optimal results. Despite well-endowed universities that can fund the required high F&A capital investments, multidisciplinary research is mostly centralized in federal intramural laboratories and a select number of innovation clusters. Nonetheless, higher F&A cost recovery for multidisciplinary research infrastructure can serve as a financial incentive to overcome these institutional-specific and infrastructural barriers to decentralize the "4th generation" research across the U.S.

The NSF Survey of S&E Research Facilities shows that the federal government funds only 7.5 percent of the costs of new construction of S&E research space (NSF, 2010). Those results closely mirror the findings communicated with the Director of NIH in 2001 which estimated a need for expansion of biomedical facilities across the nation and identified the financial roadblocks to the construction and renewal of facilities (Advisory Committee to the NIH Director, 2001). Abundant NIH funds have made more grants available to universities than what the currently available research facilities can support. Therefore, the NIH has initiated a campaign to expand extramural biomedical research facilities, especially across university campuses. In addition, the NIH has recommended that universities be reimbursed for the cost of

capital associative with investment in research facilities. Federal agencies and institutions of non-health disciplines echo the same financial and infrastructure concerns (Beene, 2010).

The lack of funding and the reliance on institutional funds and philanthropy for new research facilities not only discourage construction of new space, but also discourage the transformation of research into the "4th generation" paradigm, one that requires specially-designed space and very large capital investments. As scientists and analysts are coming to find, pragmatic multidisciplinary research is only cost-effective when housed within large and high-tech infrastructure (Phillips, 2003). The aforementioned universities that have pursued the construction of multidisciplinary research facilities relied on funds from their reserves and endowments. However, those external funds typically do not account for critical F&A costs to establish new and specialized administrative and maintenance capabilities.

A typical argument questioning whether the government ought to be paying any overhead expenses in the first place, bases its rationale on the position that the government has no obligation to pay F&A costs because universities have to incur those costs even if federal research were not performed (Noll & Rogerson, 1998). However, in the case of newly-constructed multidisciplinary research facilities, certain specialized administration and maintenance capabilities are solely associated with the multidisciplinary research performed in the facility, and thus they initially do not contribute to any additional university objectives. Hence, the only source of funding for these F&A costs is, by virtue of Circular A-21 guidelines, capped at 26 percent. Moreover, the university must compensate for the under recovery from external funds until its specialized infrastructure can administer enough federal research to reach self-sustainable F&A cost recovery. In brief, F&A cost accounts significantly for initial capital investments of multidisciplinary research facilities, and yet receives very little federal attention

and funding. This overlooked circumstance of collaborative research further discourages institutions from investments in multidisciplinary research.

An alternative strategy to fostering collaborative research advocates for increasing the federal funding of multidisciplinary research grants which promote inter- and intra- university collaborations, versus subsidizing overhead costs of new multidisciplinary research infrastructure. However, those grants are usually accompanied with unfortunate complications, high risk, and institutional cost sharing practices which can be a major institutional barrier to collaborative research (Kulage, Larson, & Begg, 2011). These institution-specific practices have pressured "researchers, administrators, and university ad hoc task forces and committees to suggest the development of processes for sharing F&A cost recovery as one way to minimize economic barriers to collaborative research across disciplines, departments, or academic institutions" (Kulage, Larson, & Begg, 2011, p. 394). In addition, studies on the effectiveness of multidisciplinary research have determined physical proximity and frequent communication amongst collaborators as crucial criteria to the fruition of optimal results from multidisciplinary initiatives (Cummings & Kiesler, 2005). Housing multidisciplinary research within the same facility and supplementing the facility with administration, tools, and services complementary to the narrow objectives of the research can promote the following: (i) relieve the institution from inchoate cost sharing principles by easing the process; and (ii) ensure optimum utility of space to interconnect collaborators and increase their joint productivity.

Yet, an alternative argument challenges the federal obligation, whether it is in the form of grants or the subsidization of facilities, to foster multidisciplinary university research, and advocates implementing this paradigm mostly at federal intramural laboratories. After all, multidisciplinary research was first introduced at federal laboratories, and excelled because of

their large infrastructure, cohesive in-house administration, and rudimentary financial accounting principles. Nonetheless, university research not only produces scientific and economic returns, but also educates the next wave of scientists and researchers. Further, the most critical problems facing mankind, in areas such as health, energy, and environment present an urgent need for multidisciplinary research efforts. Institutions which have displayed interest and demonstrated excellence in such a field should be rewarded with incentives to continue and enhance their innovative efforts using the most effective research modules. The federal government has the opportunity to decentralize the "4th generation" of research by offering additional cost recovery incentives to institutions, which can sponsor multidisciplinary research. In addition, the federal government can also assist economically disadvantaged or distressed areas of the country by introducing innovative research capacities to help flourish their regional economy and attract productive and talented personnel while empowering national objectives.

The OMB coordinates the F&A cost recovery process and therefore is the ultimate player in coordinating a new initiative to resolve the multidisciplinary infrastructure deficiency. OMB has the ultimate authority in standardizing and coordinating all research-funding agencies into providing additional, yet conditional F&A cost recovery for multidisciplinary infrastructure that seeks to resolve current national goals. Federal agencies can maintain their current principals and guidelines; however, for F&A cost recovery, rates should be higher if the facilities fulfill the criteria of collaborative research.

Cutting down on cost recovery has proven detrimental to research universities, for it shifts F&A burdens to the universities, resulting in lower research productivity. Therefore, the federal government needs to maintain its cost recovery rates and gradually increase them in anticipation of a rapidly changing research ideology. The proposed initiative will maintain the

long-defined social contract between universities and the federal government. Universities will perform multidisciplinary research, while an individual investigator has the resources to perform basic research. This in turn will support that government's national objectives to foster economic and social returns. The additional funds that distinguish a "4th generation" facility from a conventional laboratory will be compensated by the increased federal cost recovery; again, the potential is unimaginable.

Universities will find it very difficult to overlook such a tremendous opportunity. Within a couple decades of the new revision to Circular A-21 by the OMB, it is predicted that new innovation clusters equipped with integrated tech transfer will be spotted all over the country attracting industry and non-profit organizations to their periphery and forming innovation clusters (Sallet, 2009).

National goals will be tackled from various perspectives, and the strong visibility of scientific performance by those clusters will inspire the next generation of scholars to pursue professional science and technology careers. In addition, both small and large institutions will have an equal opportunity to invest in their long-term future with federally-funded infrastructure. Small institutions might be constricted with their size, but they can still continue to hold the current research model, which has its own advantages and benefits to society.

Conclusions & Recommendations

This report proposes that the National Research Council (NRC) undertake a nationwide study to evaluate the impact of multidisciplinary research infrastructure and the feasibility of the above proposed incentives through strategic F&A cost recovery revisions. This study should specifically evaluate the multidisciplinary research paradigm, identify the infrastructure

characteristics which accommodate it best, perform economic analysis on the feasibility of F&A cost incentives, and evaluate the economic and societal impact of its revision.

Multidisciplinary research has been championed as essential for innovation by universities and federal government alike. Yet, the proliferation of the multidisciplinary research paradigm faces major financial and infrastructural barriers. Collaborative research grants have successfully empowered scientists and researchers to work together, but typically they are accompanied by inchoate cost sharing practices which complicate the accounting process. It also does not guarantee the most optimum working conditions amongst collaborators, such as physical proximity and ease of communication. Proper infrastructure is needed to properly incubate the multidisciplinary research paradigm and yield the most productive results. The federal government should encourage such institutional infrastructure by providing higher cost recovery on F&A capital investments. These incentives will not only advance the level and quality of research performed at universities, but can also aid economically disadvantaged regions by infusing innovative research capacities, and ultimately empower national scientific objectives.

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