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Strategies for research continuity in light of funding uncertainties
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The University Research Committee met during the fall and spring of the 2013-2014 academic year to consider the topic of "Strategies for research continuity in light of funding uncertainties". The following represents a summary report of the discussion and conclusions of the committee.

1. Overview

The goal for USC is growth in high-quality research that is supported by growth in external research funding. Increased funding permits increased productivity from our faculty, increased overall research output from the university, increased national and international stature, and increased indirect funds for maintenance and improvement of infrastructure. Increasing total research funding to USC can be accomplished by a combination of (a) increasing the success rate of applications for funding, (b) increasing the breadth of sponsoring agencies to which faculty members submit proposals, (c) increasing the number of faculty members who apply for grants. We propose that all three areas need to be addressed if we are to optimize research funding in a time of intense competition for limited resources.

The goal for individual researchers is not only increased funding to support growth of high-quality research programs, but also continuity and predictability of funding to permit long-term high-impact projects. Without continuity and predictability, it is difficult to hire and maintain employees and students and to ensure ongoing support for projects that have recurring costs (such as care of animals or cultures, project-specific infrastructure, or maintenance and rental of equipment). Grant funding is often part of the faculty salary structure. This is true to different extents in different USC schools, but for many faculty members, grants are essential to success in their career, and for their livelihood. Not all grant funding is equal. US government funding is the most desirable, because many government agencies support full indirect costs that can be more than half of the direct costs. In contrast, private foundations rarely pay indirect costs.

The history of research funding availability shows a tendency to be cyclical, depending on the economy and government policies. This can be very disruptive to successful research. In the past, things always seemed to improve. This may no longer be the case going forward, as financial and political pressure leads to further cutbacks in government-sponsored research. Therefore it is essential that we explore all avenues for maintaining and increasing support for high-quality research.

To preserve support for individual researchers in this challenging environment, we further propose (d) increasing availability of internal USC funds that can be used to "bridge" across brief periods of reduced funding. Any improvement requires effort, and effort needs to be justified by tangible results. We therefore suggest that USC should (e) establish quantitative metrics of performance. It may be helpful to perform a formal investigation of best practices at other successful research universities in order to find additional strategies.

In the following, we propose a set of strategic solutions:

(a) Increase the success rate of applications for funding

To increase success, we need to understand the causes of failure. While there is a natural tendency to assume that a failed application reflects a weak research program on the part of the faculty applicant, this seems the least likely explanation given the strength of our faculty and the strong collaborative and supportive environment at USC. So if we assume that faculty have strong research programs and are knowledgeable in their fields, then the causes of failure in a highly competitive environment can be divided into two broad areas: (a.1) selection of projects with insufficient interest or impact, (a.2) poor communication of a project's methods or impact. While frequently successful at obtaining grant funding, faculty at USC may be at a particular disadvantage because of the interdisciplinary nature of much of our research. The more interdisciplinary and innovative a project, the less likely it is that reviewers will possess appropriate background knowledge, either of methodology or relative impact, to be able to provide a fair assessment. This heightens the need for effective communication of impact and methods, both of which may be unfamiliar to reviewers who are otherwise highly qualified within their own fields.

Optimizing selection of projects for proposals is rarely addressed. We generally assume that qualified faculty know their own fields well enough to select the highest-impact areas for research effort. However, vetting of research areas may be able to improve overall impact and research quality, either by minor redirection of effort or, in some cases, a complete change in methodology or application area. This sort of advice is generally considered the role of research mentors, but it is not universally addressed by mentors. Furthermore, senior faculty rarely have mentors, and they may not be aware of their own need for advice. Therefore we suggest two methods for improving the selection of research projects: (a.1.1) assign faculty mentors to all faculty, including senior faculty, with the explicit expectation that one of the roles of the mentor is to provide advice on decisions for submission for research funding, (a.1.2) create pre-writing review committees within and between departments to review a one-page research concept outline and provide suggestions and feedback prior to the writing of a complete grant application.

Once the decision has been made to submit a proposal for a new project, it is essential that the nature and impact of the project be communicated to funding agency reviewers. We suggest two methods for improving the quality of written grants: (a.2.1) availability of grant-writers who can assist with writing, editing, and formatting of proposals, (a.2.2) internal pre-submission review committees to perform full reviews of proposals and provide written critiques to investigators

prior to submission for funding. Grant-writers may need to be familiar with specific topic areas and relevant funding sources, and therefore this is a service that is probably best provided by individual departments. Pre-submission committees may also need to be department or school-specific, and these can be the same committees that perform the pre-writing review (a.1.2). These committees need to be familiar with the funding source so that reviews can be most relevant. In some cases, proposals could be sent out to external reviewers. The opportunity for pre-submission review already is available through CER and in some cases through schools and departments, but many faculty members are unaware of this opportunity, and proposals are rarely completed in enough time to allow review and revision prior to submission deadlines. Therefore pre-submission review committees should be organized within schools or departments, and a clear review cycle and deadlines should be established.

There are thus two pre-writing and two pre-submission components to improvement of written proposals: (a.1.1) mentor review of concept, (a.1.2) pre-writing committee review of concept, (a.2.1) grant-writer editing of proposal, and (a.2.2) pre-submission committee review of proposal. While we believe that in the end this will reduce faculty workload by increasing the quality of submissions and reducing the effort spent on unsuccessful submissions, we realize that faculty are already heavily burdened. We therefore suggest an "opt-out" system, in which the expectation is that both pre-writing and pre-submission advice be used, but investigators wishing to bypass pre-review may do so if they provide a written explanation stating that it is impossible (usually due to time constraints) or inappropriate for the project.

(b) Increase the breadth of sponsoring agencies to which faculty members submit proposals

Successful funding requires that the proposal be well matched to the priorities and goals of the funding source. Therefore it is important that the most appropriate potential funding sources be identified, and that the application is targeted appropriately for their priorities. The barriers to application include (1) lack of knowledge of funding opportunities, (2) time required for writing proposals to target the audience and format required by different funding sources. We suggest (b.1) maintenance within each school of a list of potential funding sources, including both public and private sources of funding, and (b.2) availability of grant-writers who can re-write proposals to target additional funding sources, with minimal need for faculty intervention. It is important not to sacrifice quality of applications for quantity, but a single high-quality application will have a higher chance of funding if it can be reviewed by multiple sources. This is an additional role for the grant-writers mentioned above, but it emphasizes the multiple potential areas of impact that writers can have. Lists of potential funding sources have been created by other universities, and we can certainly access those. Recent availability of the GrantForward website will be a tremendous resource. The important issue is to make faculty aware of the broad range of funding sources. Many sources provide only small amounts of funding or have low probabilities of success, but if the time required to re-write an application is minimal (because it is being done by a grant-writer) then faculty have the opportunity to apply. This may be particularly helpful for inter-disciplinary proposals, for which faculty may be unaware of funding opportunities in related or collaborating fields.

In addition, USC should strive to identify sources of funding from industry and private sources that may not represent advertised opportunities. For example, industry-sponsored research studies

(particularly relevant to Medicine and Engineering areas), government sources for industry-academia collaborative funding (such as the SBIR or STTR mechanism from NIH), and the possibility of joint venture agreements around specific projects. The Stevens Institute, CTSI, and HTE@USC provide examples of important channels to such sources. Non-advertised private sources include private or family foundations that often do not have identifying websites but that may be identifiable from available lists of such foundations, or from tax returns filed with nonprofit status. Assessing the funding interests of such foundations may take some effort (it may require examining prior-year tax returns to look for previous funding history), and in this case we suggest that schools consider (b.3) hiring a school-based "funding opportunity researcher" to perform thorough background checks on school-specific opportunities, contact small foundations, and match faculty to foundations.

(c) Increase the number of faculty who apply for grants

In the Life Sciences and Engineering there is a long tradition of external grant support for research. In many other fields including Social Sciences, grant support is less common. Even within traditionally funded fields, many faculty members (for example, clinically-oriented faculty at Keck) do not normally apply for external funding. We recognize that many faculty members neither need nor want funding, and there is no point in forcing faculty to do research if they are uninterested or untrained to do so. Yet there may be a pool of faculty with the interest and ability to perform funded research that do not do so due to factors that could be ameliorated by USC. The primary barriers to funding for this subgroup of potentially funded faculty are (1) lack of familiarity with grant opportunities, (2) lack of familiarity with the logistics of the grant application process, (3) lack of experience with selection of projects for support, (4) lack of experience writing grants, (5) lack of departmental policies and infrastructure to permit and encourage externally-funded research. The solutions to many of these barriers are embedded in solutions to other issues raised elsewhere in this document. In particular, we suggest (c.1) maintenance of lists of funding sources relevant to the school or department, as in b.1, and hiring funding opportunity researchers, as in b.3, (c.2) seminars, workshops, and mentorship on grants and grantwriting, including those already available from CER, and mentorship as suggested in a.1.1, (c.3) mentorship and department pre-submission committees as in a.1.2, (c.4) mentorship and availability of grant-writers and other support personnel with experience in the relevant field, as in a.2.1, (c.5) school-wide policies that are propagated to individual departments for creation of protected time and assignment of support personnel (for budget and regulatory issues) for faculty who achieve funding. It may be helpful to encourage individuals and departments by publishing reports on total indirect costs contributed, so that those with success can be proud of their accomplishments while those who have not applied can be made aware of the potential benefit not only to themselves but to their schools.

(d) Increase availability of internal USC "bridge" funds

Internal funds can be leveraged to obtain increased external funding. This results both from internal funds for small pilot studies or establishment of collaborations that then are expected to lead to significantly greater external funding, as well as from internal funds used to "bridge" researchers across brief lapses in funding. Some schools have programs in place for bridge funding. The more funds that are available, the more researchers can be supported and the longer

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a period of reduced funding can be tolerated. Our only suggestions are that it may be possible to (d.1) increase availability of internal pilot or bridge funds through philanthrophy specifically directed at this area, (d.2) extend bridge funding by providing "in kind" support. For example, temporary tuition waivers for otherwise unfunded students in laboratories that are temporarily unable to offer research assistantships, or no-cost or reduced-cost access to core facilities and shared administrative support to continue research or obtain preliminary data for new projects during periods of reduced grant funding.

(e) Establish quantitative metrics of performance

USC already maintains and disseminates information on total grant funding by school, department, and researcher, and these metrics can be used to determine overall performance and set meaningful targets. We suggest (e.1) funding metrics should be correlated with attempts at intervention (such as the recommendations above) to assess efficacy of changes, (e.2) fraction of faculty involved in research should be reported for schools and departments, in addition to total research funding, (e.3) number of *different* grant types applied for and received should be reported by school and department, (e.4) success rate for applications should be reported by type of grant, school, and department, with this success rate for individual faculty available privately. The use of these metrics will allow us not only to measure the efficacy of interventions, but also to identify areas where additional effort could lead to significant improvement in funding. We need to constantly evaluate potential barriers to funding, factors that reduce success rate in applications, and the incentives and disincentives that affect whether faculty choose to apply for funding.

However, we emphasize that quantitative performance metrics such as these measure the quantity of grants and funding but do not assess the quality or potential impact of the funded projects. Our goal must always be to increase the quality and impact of our work. Obtaining funding is an essential step in this process, and the metrics above are intended to support that step. But these metrics only indirectly reflect quality of work and should thus be interpreted and used only as narrow measures of financial support and not as broad measures of quality.   In particular, it is important that faculty and departments not be judged on the quantity or magnitude of grants submitted, but rather on the quality and impact of their work.

Summary of Potential Strategic Solutions:

(a) Increase the success rate of applications for funding
    (a.1) Improve Selection of research projects
        (a.1.1) assign faculty mentors to all faculty, including senior faculty, with the expectation that one of the roles of the mentor is to assist decisions for submission for research funding,
        (a.1.2) create pre-writing committees within and between departments to review one-page research proposal outlines prior to the writing of a complete grant application.
    (a.2) Improve quality of communication and writing of proposals
        (a.2.1) hire grant-writers who can assist with writing, editing, and formatting of proposals,
        (a.2.2) create departmental or school pre-submission committees to perform full reviews of proposals and provide written critiques to investigators prior to submission for funding.

(b) Increase the breadth of sponsoring agencies to which faculty members submit proposals
    (b.1) maintain within each school a list of potential funding sources, including both public and private sources of funding (the recent availability of the GrantForward system strongly supports this goal),
    (b.2) hire grant-writers who can re-write proposals to target additional funding sources.
    (b.3) hire school-based "funding opportunity researchers" to perform thorough background checks on school-specific opportunities, contact small foundations, and match faculty to foundations.

(c) Increase the number of faculty who apply for grants
    (c.1) maintain lists of funding sources relevant to the school or department,
    (c.2) provide seminars, workshops, and mentorship on grants and grantwriting, including those already available from CER, and mentorship as suggested in a.1.1
    (c.3) create mentorship and department pre-review committees as in a.1.2,
    (c.4) support mentorship and availability of grant-writers with experience in the relevant field, as in a.2.1,
    (c.5) encourage school-wide policies that are propagated to individual departments for creation of protected time and assignment of support personnel for faculty who achieve funding.

(d) Increase availability of internal USC "bridge" funds
    (d.1) increase availability of internal pilot or bridge funds through philanthrophy specifically directed at this area,
    (d.2) extend bridge funding by providing "in kind" support of students, core facilities, or services.

(e) Establish quantitative metrics of performance
    (e.1) funding metrics should be correlated with attempts at intervention to assess efficacy of changes,

(e.2) fraction of faculty involved in research should be reported for schools and departments, in addition to total research funding,

(e.3) total number of different grant types applied for and received should be reported by school and department,

(e.4) success rate for applications should be reported by type of grant, school, and department, with this success rate for individual faculty available privately.