In the following report, The Hanover Research Council examines interdisciplinary research (IDR) at U.S. universities. We begin with a preliminary overview, which includes an assessment of the future prospects for IDR and a note on nomenclature. This is followed by an examination of three IDR administrative categories: finances, organization and management, and evaluation. For each of these categories, Hanover describes the challenges posed by IDR, expert recommendations from the literature, and examples of effective practices from U.S. universities. The final section of the report summarizes key findings.
Introduction

Interdisciplinary research (IDR) is an important and increasingly common mode of scientific inquiry at U.S. universities, other public institutions, and private companies. This report explores several aspects of interdisciplinary research, as it is conducted at U.S. universities. Specifically, we have devoted independent sections of this report to each of the following IDR administrative categories: finances, organization and management, and evaluation. For each of these categories, we survey the literature in the field in order to illuminate the unique challenges posed by IDR before examining expert recommendations on how best to meet those challenges. Ultimately, we suggest that there are broad similarities among effective administrative practices in each category examined. In other words, the financial, administrative, and evaluative aspects of successful IDR efforts necessarily overlap, and good or bad practices in an area such as financial management are likely to affect performance (a fact which must be accounted for during the evaluation process) and organizational structure.

Before we examine each of these three IDR administrative categories in detail, it is important to establish the parameters of our study by providing some preliminary assessments. We begin by describing IDR, as it is formally defined in the literature; we then examine the future prospects for IDR. Finally, our overview ends with a note on IDR nomenclature (i.e., we explore how universities commonly refer to their own IDR institutions).

Defining Interdisciplinary Research

There is a general consensus among experts regarding the formal definition of IDR. In their 2007 article, “Institutional Challenges of Interdisciplinary Research Centers,” Glied et al., define IDR as

…any study or group of studies undertaken by scholars from two or more distinct scientific disciplines. The research is based upon a conceptual model that links or integrates theoretical frameworks from those disciplines, uses study design and methodology that is not limited to any one field, and requires the use of perspectives and skills of the involved disciplines throughout multiple phases of the research process.1

This definition focuses on the relationship of the scholars engaged in the research, emphasizing their use of concepts and methods from more than one discipline. This is a common aspect of IDR definitions. On the part of scholars, the key to making research “truly interdisciplinary,” as opposed to merely “multidisciplinary,” rests on

their integration of two or more traditional academic disciplines. Similarly, in its authoritative book, *Facilitating Interdisciplinary Research* (2005), the National Academy of Sciences (NAS) Committee on Facilitating Interdisciplinary Research cites the integration of academic fields as a key aspect of IDR. However, the committee’s definition also stresses the importance of the object of study:

Interdisciplinary research (IDR) is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or field of research practice (emphasis added).

In addition to the integration of academic disciplines, the committee holds that the second key aspect of IDR is that the research question, in addition to the researchers, must also be interdisciplinary. That is to say, the problem upon which the research is focused must be so broad, complex, or technologically demanding as to be beyond the capabilities of a single discipline. In short, then, IDR involves the integration of disciplines to confront research questions that are sufficiently complicated to be beyond the scope of one traditional academic field.

**Future Prospects**

By all indications, IDR is on track to become increasingly important in the coming years. There are several reasons why this is a likely outcome. First, and most importantly—as is clear from the above definition—IDR is ideally suited to finding solutions to complex problems, and, experts agree, there is no shortage of far-reaching and highly pertinent questions presently facing humanity and likely to arise in the future. The National Science Foundation (NSF), in its report, “Impact of Transformative Interdisciplinary Research and Graduate Education on Academic Institutions” (2008), describes several complex modern issues whose study and resolution are likely to require an interdisciplinary approach:

From global sustainability to renewable energy to the origins of life in the cosmos to forecasting and potentially mitigating economic upheavals, the largest scientific challenges—and those that may hold the greatest opportunity for transformative technological solutions into the 21st century—are interdisciplinary in nature.

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Indeed, the need for science and academia to “solve societal problems,” which arise from the “inherent complexity of nature and society,” is commonly cited in IDR related literature as the major impetus behind the expanding IDR capabilities of U.S. universities.5

Contributing to the likelihood of continued IDR expansion, Federal and other funding agencies have been increasingly supporting IDR centers/projects.6 A representative example of this practice comes from the National Institute of Health (NIH). According to the 2004 NIH Roadmap, which is designed to help guide medical research into the 21st century, funding IDR is a top priority.7 The NIH report observes that “planning for interdisciplinary research requires changes in all aspects of science conduct and support, including the training of investigators and development of new research methodologies.” To keep up with these changes, the NIH has provided funding to several initiatives designed to train IDR researchers, develop IDR methodologies, and create IDR centers.8

Universities have responded to the challenges posed by IDR—which include the inherent complexity of its research topics—and to the opportunities for funding assistance, by increasing their capacity for IDR. The NAS Committee on Facilitating IDR notes that “interdisciplinary centers, institutes, programs, and other structural mechanisms have proliferated on and adjacent to university campuses; indeed, these research units often outnumber traditional departments.”9 The overall growth of IDR centers reflects administrators’ awareness of, and consensus regarding, the enhanced role IDR will play in their universities’ futures. Since the turn of the millennium, universities’ strategic plans have shown an increased emphasis on interdisciplinary approaches to research and graduate education.10 Irwin Feller captures the reasoning of many administrators as they seek to increase their institutions’ IDR capacity:

…both established and aspiring research universities recognize that they operate within multiple competitive environments, in which their success at what Stephen Stigler has termed “intellectual competition” depends upon the importance, novelty, and currency of their ideas. Strategic planning focused on interdisciplinarity reflects the latter’s heightened standing as a competitive

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<http://www.changemag.org/Archives/Back%20Issues/November-December%202007/abstract-interdisciplinarity.html>

7 “NIH Roadmap for Medical Research.” National Institute of Health. <nihroadmap.nih.gov/>
8 Ibid.
strategy for enhancing institutions’ performance, national rankings, and capacity to secure external funds.\textsuperscript{11}

We shall go into greater detail regarding the strategies universities employ to increase IDR funding in the Finances section of this report. For the moment, it should be clear that universities and their administrators have been and are likely to continue expanding their IDR capacities in response to both funding-related and mission-related pressures.

Finally, it is important to note that the increased institutional emphasis on IDR has been matched by increasing demand among students for IDR opportunities. Undergraduate students are drawn to fields of study that are designed to answer the complex social, economic, and ecological problems of our day. As such, course offerings in the “hard sciences” are much more popular if they are explicitly designed to address pressing modern problems like climate change, disease prevention, and sustainability, all of which are necessarily interdisciplinary in nature. The same is true of courses that focus on economic development, inequality, and other modern sociopolitical research questions.\textsuperscript{12} The NAS Committee on Facilitating IDR cites three examples of the strong appeal of interdisciplinary programs taken from Stanford University, the University of Michigan, and the University of Colorado. In each case, the institution in question experienced heightened enrolment in its science course offerings when interdisciplinary elements were added.\textsuperscript{13} Students increasingly seem to be thinking in terms of practical application and seek a greater context for their work – in many cases large, pressing, interdisciplinary problems seem to provide this interpretive framework.

**Nomenclature**

When research is no longer confined to the Physics Department or the Sociology Department alone, for example, and involves multiple departments, universities must devise a new nomenclature to describe their IDR functions. In reviewing academic literature and surveying numerous universities’ IDR websites, it becomes clear that universities are far from settling on an accepted norm for differentiating IDR “institutes” from IDR “centers.”

That said, there is one trend in IDR nomenclature that deserves some attention. Often, universities that are engaged in IDR will have a variously named over-arching IDR “institute” which has one or more IDR “centers” subsumed within it. For example, the University of Connecticut’s Institute of Materials Science contains several IDR centers at any given time and freely forms and dissolves them as the need arises. According to its website, The Institute of Materials Science

\textsuperscript{11} Ibid. P 1.
\textsuperscript{13} Ibid. P 157-8.
…has within its structure the ability to define research centers that address major multi-investigator basic materials research areas. Centers are formed as the technical reason exists and are dissolved when the technical need or research funding is no longer available. The present existing Centers are the long existing Electrical Insulation Research Center (EIRC) and the more recently formed Center for Advanced Deployable Nano-Sensors.\(^{14}\)

This practice of creating a “parent institute” with several subordinate centers is also evinced by Pennsylvania State University. Penn State’s massive IDR amalgam, called The Huck Institutes of the Life Sciences, has numerous subsidiary IDR centers which include, for example, the Center for Cellular Dynamics, the Center of Excellence in Nutrigenomics, and the Center for Chemical Ecology.\(^{15}\) It should also be noted that, in addition to these and other IDR centers, there are several subsidiary IDR “institutes” which constitute the Huck Institutes – the Institute for Diabetes and Obesity is one example.

There is no formal university-wide standard in place when it comes to naming IDR entities. It appears that perhaps the most important criterion, when naming IDR institutes/centers, is purely aesthetic. Who could deny that the name, “Institute for Nonlinear Science” has a certain panache that the “Nonlinear Science Center” lacks?\(^{16}\) Throughout the IDR literature, the words “center” and “institute” are used interchangeably when referencing unspecified IDR institutions. As such, the same practice is maintained in the present report.

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\(^{14}\)“The Institute of Materials Science.” University of Connecticut. <www.ims.uconn.edu/facilities/centers.html>

\(^{15}\)“The Huck Institutes of the Life Sciences.” Pennsylvania State University. <www.huck.psu.edu/institutes-and-centers>

\(^{16}\)“Institute for Nonlinear Science.” University of California San Diego. <inls.ucsd.edu/>
Section 1: Finances

Our discussion of financing practices for IDR at U.S. university campuses covers two main points. We begin with an examination of the available data on the amount and duration of funding typically provided by the parent university for a start-up IDR project. This is a key figure in estimating the level of financial commitment, in the form of “seed money” or “venture capital,” that is required from an institution in order to initiate and sustain an IDR project. We also explore financial administration strategies that are designed to facilitate IDR.

In addition to evaluating initial and sustained investments in IDR programs, we describe ways in which universities may succeed in generating outside funding for interdisciplinary research. Our analysis covers successful practices at major universities in addition to surveying expert recommendations from the literature, which form the basis of this portion of the report.

Seed Money

The NAS Committee on Facilitating IDR has identified limited resources as one of the major challenges to developing IDR centers/projects on college campuses. Part of this stems from the competition for institutional funding, which is in many ways a zero-sum game. Given that universities’ financial resources are limited, diverting funds to help incubate IDR programs necessarily means that some other program will see its funding diminished. In the face of these high stakes, universities must do everything possible to ensure that money dedicated to IDR is wisely invested.

The NAS Committee recommends that universities establish methods for overseeing the distribution of IDR funding. For example, an advising committee, composed of successful IDR faculty, with the power to recommend or oppose funding, could help ensure that only those IDR projects that are most likely to be successful, such as those proposed by accomplished senior faculty and/or promising junior faculty with potentially long-term implications, are chosen to receive funding.

One way to help ease inter-departmental competition for limited resources, while still fostering IDR, is to set aside funding that is earmarked for exclusive use in IDR projects. The NAS Committee highlights the need for universities to be proactive about their allocation of funding for IDR:

Universities could use such funding (which is now often used to hire new faculty) when existing faculty propose a major new initiative or interdisciplinary center. Without such startup assistance, it is difficult for

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18 Ibid. P 88.
established researchers to reorient their research, because funders may be hesitant to shift toward an unproven approach. In such cases, it is important for universities to lead, not follow, the funding agencies.\footnote{Ibid. P 54-5.}

Clearly, universities that wish to stay abreast of developments in IDR will want to make financial resources available to support initiatives in the field. The question remains, though, as to how much seed money is typically required (and granted), to initiate an IDR project, and how long this funding is sustained.

To answer these questions, the NAS Committee surveyed university faculty, administrators, and provosts about their universities’ IDR funding policies.\footnote{A detailed description of the survey instrument can be found in, \textit{Facilitating…} Op. cit. P 254.} The survey found that the majority of the universities represented provide direct financial assistance to new IDR projects. Though the amount of seed money provided varies from $1,000 to $1 million, most frequently the awards fell within the $10,000 to $50,000 range.\footnote{Ibid. P 85.} With regard to the duration of these grants, the same survey found that universities most often award funding for one to two years (about 61\% of respondents), while grants of two to five years were next most common (about 24\% of respondents).\footnote{Ibid. P 265-7.}

While the initial investment in an IDR center is likely to exceed subsequent allocations, universities’ commitment to facilitating IDR must often go beyond one or two years of generous financial support. Feller writes that

\begin{quote}
\ldots to the extent that interdisciplinary initiatives are funded by… institutional seed money, sustaining these initiatives when the awards end depends on a steady and rising flow of institutional funds. Like the often-cited experience of start-up firms, once the initial endowment is expended, fledgling interdisciplinary programs enter the (resource) valley of death, from which they may not exit.
\end{quote}

Universities may employ several financial stewardship policies to ensure that their IDR projects remain viable after their initial allocations are expended. These measures are designed to create “equitable and flexible budgetary and cost-sharing policies that support IDR.”\footnote{Ibid. P 112-3.}

In order to ensure the continued success of established IDR projects, the NAS Committee recommends that universities adopt the following practices:

\begin{itemize}
  \item \textbf{Facilitate Inter-departmental Resource Sharing:} Administrators should seek to develop streamlined, fair, and equitable budgeting procedures to
\end{itemize}
facilitate sharing and exchange across department or school lines in order to allocate resources to interdisciplinary units outside the departments or schools.

- **Improve Non-Monetary Resource Sharing:** Create a campus-wide inventory of equipment to enhance sharing and underwrite centralized equipment and instrument facilities for use by IDR projects and by multiple disciplines.

- **Credit Indirect Costs to IDR:** Credit a percentage of all projects’ indirect costs to support the infrastructure of research activities that cross departmental and school boundaries.

- **Project-Based Space Allocation:** Allocate research space to projects, as well as departments.

The NAS Committee gives several examples of universities that have developed innovative funding practices that apply one or more of the four recommendations above.\(^\text{24}\) We have summarized a number of these examples below.

- **University of California Davis:** For the past thirty years, UC Davis has employed two primary methods to facilitate IDR financing. First, funds are distributed from a central office directly to interdisciplinary programs without going through the deans. In addition to this direct allocation strategy, matching funds are channeled from a central office, such as the graduate school, in order to support the program.

- **University of Michigan:** Michigan changed its budget model to make it more favorable to the management of interdisciplinary work. In contrast with their previous system of incremental budgeting, the new budget system provides a mix of activity-based and discretionary budgeting. Through this balance, the provost and president retain considerable discretion in funding initiatives at the school, college, or research-unit level independently of current revenue-generating capacity. The University of Michigan system is designed to reserve flexible resources that can then be reallocated across units to fund IDR projects.

- **University of Washington:** UW’s Program on the Environment (PoE) is a horizontally organized, university-wide institute. The PoE is not a traditional academic department and does not have a faculty of its own. Instead of allocating money through departments to pay for faculty, the university has set aside a permanent budget that the PoE uses to hire faculty in collaboration with departments and schools.

\(^{24}\) Ibid. P 108-9, 180.
Columbia University: Columbia has secured innovative financial resources, such as revenues generated from the licensing of intellectual property, to invest in new interdisciplinary research and teaching initiatives.

External Funding

Universities that set the development of IDR as a priority often grant seed money and have budgeting and other procedures in place, but external funding—commonly in the form of federal grants—still plays a significant role in financing IDR at U.S. institutions. Glied et al. report that of the 65 Columbia University IDR centers examined in their report, a significant majority began with a substantial external grant, while only a small number were created by institutional funding.\(^{25}\) As a highly-ranked private university, Columbia may not be a representative case. Nevertheless, the importance of external, particularly federal, funding should not be underestimated and can make the difference between a breakthrough project and a defunct IDR center.

As indicated in the Introduction of this report, federal funding initiatives in support of IDR have been an important impetus behind universities’ expansion of their IDR capacities. The National Institute of Health is one example of a federal government agency with an IDR funding agenda, but there are many others including the National Aeronautics and Space Administration, Department of Defense, Defense Advanced Research Projects Agency, and National Science Foundation.\(^{26}\)

The funding practices of the National Science Foundation (NSF) are of particular interest to university administrators who seek to organize and manage their institutions’ research endeavors in order to effectively compete for federal funding. Like many federal agencies, the NSF has made developing and supporting IDR a top priority. One key indication of that commitment is the increasing proportion of NSF funds devoted to research projects with multiple “primary investigators” (PI). Having more than one PI is a good proxy measure for interdisciplinarity, since multiple PI projects are unlikely to have two or more PIs in the same academic discipline.

The chart below displays the amount of funding, in millions of dollars, granted to single PI and multiple PI research projects from 1982 to 2001. As the data make clear, the increase in funding of multiple PI projects has rapidly outpaced that of single PI projects. During the twenty-year period, multiple PI funding increased from $168 million to $1.13 billion, a 572% change, while single PI funding increased from $467 million to $1.11 billion, a comparatively small 137% change. Similarly, multiple

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PI funding grew at a rate of nearly 29% per year, while single PI funding grew at a considerably slower annual rate of about 7%.

Data are only available up to the year 2001, but given the linear trend towards increased multiple PI project funding, we have good reason to expect that the NSF will continue to emphasize IDR project funding into the future. In May 2008, the NSF held a two-day IDR workshop, which was offered “because of the growing acknowledgment of the importance of discoveries and outcomes of interdisciplinary, cutting-edge science and technology for economic and societal growth and vitality.”

Universities that wish to capitalize on this trend in NSF funding may wish to consider submitting more grant proposals with multiple primary investigators with representation beyond a single discipline.

Despite the fact that the NSF regularly increased IDR funding throughout the 1980s and 1990s, competition for federal dollars remains fierce. In fact, the concern among academics regarding the availability of federal research funding has become acute enough that it prompted a group of seven premier research universities to publish a 2008 report on the matter entitled “A Broken Pipeline? Flat Funding of the NIH Puts a Generation of Science at Risk.”


The report points out that the NIH has received flat funding since 2003 and claims that the United States risks losing a generation of young research scientists who find themselves unable to secure financial support for research projects and, consequently, leave academia for other positions. This alleged danger facing government funded research projects appears to be credible. From 1999 to 2007, the overall success rate for NIH research project grant proposals dropped from 32% to 24%. During the same period, the first-submission success rate fell by half, from 24% to just 12%. This second statistic is indicative of the particular difficulty that young researchers face, when applying for NIH funding. The writers of the report note that “in this difficult fiscal climate, [NIH] reviewers are becoming more demanding and more conservative in their evaluations” and that “as a result, first-time investigators are facing greater hurdles to becoming independent investigators.” As such, the average age of researchers receiving their first NIH grant has increased from 39 years old in 1990 to 43 years old in 2007, and the proportion of grants that are awarded to first-time investigators decreased from 29% to 25% during this period.

Given that the current economic downturn can only have exacerbated these already worsening conditions, universities that wish to increase their chances of receiving NIH funding would be well advised to focus on research proposals constructed by experienced and senior-level faculty. Moreover, the proposals that are most likely to be successful may be those that involve multiple senior-level primary investigators.

Before we move on to describe effective IDR organizational and management practices in greater detail, it may be beneficial to examine the practices of an institution that has had exceptional success acquiring external funding for IDR projects, in spite of the unfavorable economic environment. Purdue University, for example, generated $333.4 million in research funding during Fiscal Year 2007/2008. A significant portion of that comes from a 36% increase in funding for Purdue’s interdisciplinary research hub, Discovery Park, which saw a jump in financial resources from $54 million to $73.7 million over the previous year. University administrators attribute their success to strategic planning initiatives designed to “create a culture where we can take faculty out of departments, colleges and schools and put them in research-driven centers.” Furthermore, Purdue has invested over $175 million in new facilities and laboratory equipment for Discovery Park, a fact which many of the newly recruited faculty members cite as a key factor in their decision to come to the university. Purdue’s example demonstrates that, when resources are available, investing in modern facilities and equipment can ultimately pay dividends in the form of external research dollars.

29 Ibid. P 3-4.
30 Ibid. P 5.
32 Ibid. P 2.
33 Ibid. P 2.
Section 2: Organization & Management

Section 1 describes effective financial administration strategies for securing external funding, and while it is not primarily financial in nature, the information contained in this section of the report may also help increase universities’ IDR centers’ competitiveness for external funding, insofar as well organized IDR centers are more likely to produce successful grant proposals. In the pages to follow, we examine the best practices for establishing and supporting new IDR institutes via a survey of the relevant literature. Some of the major topics that are covered include effective practices for creating organizational structures that facilitate IDR, fostering interdepartmental collaboration, and managing the academic workplace.

In order to provide a context for these observations, we begin by examining the challenges facing IDR initiatives as cited by experts, university administrators, and faculty. We then discuss the recommendations from the literature and this same group of experts regarding the best ways to overcome these obstacles and facilitate successful IDR programs.

Challenges

In addition to the previously discussed challenge of limited resources, there are several additional commonly cited obstacles facing IDR programs. Foremost among these are the academic reward system, differences in institutional culture, insular department administrators, and lengthy startup times. According to the NAS survey, described above, 71% of university faculty and staff and 90% of provosts believe that there are major impediments to IDR at their universities.34

Perhaps the most significant obstacle to IDR, aside from financial questions, is the traditional academic reward system. Many interdisciplinary researchers find that their universities’ reward systems fail to properly acknowledge their accomplishments. In fact, among faculty, staff, and provosts, unfavorable promotion criteria is the most frequently cited impediment to IDR.35 This is due to the fact that most universities maintain a more traditional institutional structure, where decisions regarding hiring, tenure, promotions, space allocation, and other faculty rewards are made at the department level. Often, faculty members receive credit only for work completed within and for their home department. As such, interdisciplinary researchers, who often publish and teach outside of their department, may not receive full recognition for their work. Needless to say, inconsistencies in department level reward allocations can hurt interdisciplinary researchers’ prospects for promotion, tenure, and other benefits.36

35 Ibid. P 76.
36 Ibid. P 88.
As an example of this phenomenon in which interdisciplinary faculty members sometimes fall through the administrative cracks in their respective departments, Borrego describes the difficulties faced by engineering faculty who engage in collaborative work with education faculty. She writes that

…because engineering education work is inherently cross-disciplinary, each of the traditional disciplines often sees limited value in it. Both engineers and non-engineers alike were sometimes discouraged from entering into engineering education collaborations because, as one faculty member reported his dean of engineering said, “I can't give you credit for doing this.” Another engineer explained, “This has no bearing whatsoever on my tenure because it's education.” Still another engineer said that his engineering education collaboration likely didn't have any effect on his career…

This example is typical of the challenges that many interdisciplinary researchers face within their home departments as they seek to expand their research horizons.

Interdepartmental differences in institutional culture and priorities, much like those highlighted in the Borrego example above, are a challenge for many faculty and staff involved in IDR. Indeed, according to the NAS Committee on Facilitating IDR,

…the commonest cause of underperformance of IDR is the failure of a team to gel or function collaboratively. That may happen for various reasons: individual members may place the importance of their own work ahead of the team vision, devalue the contributions of other team members, or lack leadership.

Some of the resistance to IDR on the part of department chairs and other administrators stems from a lack of uniformity across disciplines in terms of methodology and publication standards. Thus, while the inability or refusal of molecular biologists and organic chemists to collaborate, for example, may seem to be merely an example of the “narcissism of minor differences,” it may actually reflect important distinctions in departmental policies and procedures that must be addressed in order to facilitate success.

The NAS committee lists a number of practices, often department or field-specific, that can become issues when scholars collaborate on IDR projects. These include:

- Allocation of indirect-cost recovery funds
- Organization of research and teaching

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Allocation of credit for multi-author papers, especially when authors are in different disciplines or institutions

Control of space or capital-intensive facilities

Agreement on standards for recruiting and evaluating faculty with joint appointments

These administrative disparities, in combination with interdepartmental differences in methodology, significance thresholds, and writing styles, may be prohibitive to the creation of a successful IDR center/project. As Glied points out, a desire to do interdisciplinary work, on the part of researchers, does not alone guarantee success. She observes that

…excellent disciplinary researchers committed to a problem area and excited by the prospect of collaborating with others may nonetheless fail to thrive in an interdisciplinary research environment. Centers depend on faculty who are both rigorous scholars and can function well in an institutionally unusual environment. They must be willing to learn the language and constructs of other disciplines. They must have, as one center director put it, a high level of intellectual curiosity, tolerance for ambiguity, and ability to play with others (emphasis added).

The difficulties inherent in developing quality interdisciplinary researchers, as illustrated by the above quotation, pose a challenge for IDR center directors since they are the ones who are usually responsible for recruiting faculty. Often, directors find that younger researchers are more enthusiastic about and better suited for IDR, but (as indicated above) experienced senior faculty are pivotal in securing the major grants that are required to sustain the center. More experienced scholars are increasingly likely to have secured tenure and may therefore have greater leeway in terms of the types of projects they can engage in, but they tend to be less enthusiastic about interdisciplinary research than younger scholars and scientists.

In addition to the inherent structural obstacles to IDR, there are also political issues that may cause problems from time to time. In some cases, it is the attitude of individual departments or department administrators that obstructs progress in an IDR venture. Feller describes numerous examples of department heads and college deans who, because they are personally opposed to IDR, effectively prevent their faculty from collaborating with other departments and treat their academic domain like a “fortress.” Similarly, IDR funding proposals submitted at the college level are

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41 Ibid. P 4.
42 Ibid. P 4.
often hampered by the lack of IDR representation on the relevant faculty review panels. 43

Finally, expectations for a project must take into account the possibility that the learning curve will be more extensive than expected. IDR requires researchers to learn the language of another discipline, and this obstacle often leads to participants taking additional time to complete a project. The NAS notes that

…the policies and procedures specified by funding organizations and major universities do not always accommodate that need [for startup time]. The extra time required for IDR, even if well spent, can lead to fewer substantive results and publications, but the tenure and funding clock is not calibrated to take such activities into account. 44

The lengthy start-up times associated with IDR, in addition to other obstacles such as the traditional academic reward system, differences in institutional culture, and insular department administrators, must be accounted for if university administrators wish to give a new IDR center or project the best possible opportunity for success. The following subsections provide recommendations for overcoming these obstacles.

Revising the Academic Reward System

In the aforementioned NAS survey, respondents were asked, “If you could recommend one action that departments could take that would best facilitate interdisciplinary research, what action would that be?” Among those who provided a suggestion, approximately 34% recommended that departments “recognize and reward faculty and other researchers for interdisciplinary work.” 45 Responding to this imperative, the NAS Committee on Facilitating IDR notes that universities seeking to generate successful programs must recognize “that the contributions of a person in IDR may need to be evaluated differently from those of a person in a single-discipline project.” The NAS lists several procedures that universities may follow in order to create an academic reward system that is more conducive to IDR. We have replicated this advice in the bulleted list below. 46 Note that indented points are itemized under broader (boldface) headings where appropriate.

**NAS Recommendations for Structuring the Academic Reward System to Facilitate IDR**

- Use Interdisciplinary Review Committees to Assess Projects: Program planners establish interdisciplinary review committees to evaluate faculty who

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46 Ibid. P 110-3.
are conducting IDR rather than relying upon departmental committees to do so.

- **Base Tenure Decisions on IDR Work:** For interdisciplinary scholars, it may be necessary to extend the venue for tenure review beyond their nominal department in order to grant them a fair appraisal.

- **Grant More Weight to Cooperative Research:** When reviewing authorship credit, tenure or evaluation committees should increase recognition of co-principal investigators’ research activities.
  
  - Develop mechanisms to evaluate the contribution of each member of an IDR team.
  - Experiment with alternatives to departmental tenure through new modes of employment, retention, and promotion.
  - Allow faculty to receive full credit for team teaching in interdisciplinary courses.
  - Encourage participants to develop appropriate ways to share credit, including authorship credit, for the achievements of the team.

Adding to these NAS suggested procedures, the National Science Foundation makes the following related recommendations.

**NSF Recommendations for Structuring the Academic Reward System to Facilitate IDR**

- **Reward Successful Interdisciplinary Initiatives:** Program planners should, for example, allocate space and additional faculty to successful programs in their own right, rather than through their parent academic departments.

- **Update Assessment Models to Account for IDR:** Administrators should develop new models for evaluation of faculty contributions to interdisciplinary work. All parties should agree on the metrics used, which may include distribution of grant overhead funds and credit for multi-authored publications, patents, and grants. Faculty should have a mechanism by which they can explicitly identify and communicate their individual contributions to multi-investigator interdisciplinary projects and publications.

- **Have an Evaluation System in Place in Advance:** Policies for tenure, promotion, and raises must be laid out well in advance. These decisions are typically made within departments, and interdisciplinary activities take place across departments, so extensive advance planning at the beginning of an IDR endeavor can help to clarify expectations.

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**Make Faculty Workload Assignments Transparent:** If the workload is shared across departments and/or other units, then a formal written agreement such as a Memorandum of Understanding should be reached among all participating parties. Planners must recognize and address the potential difficulties inherent in faculty appointments that cross administrative units and therefore require faculty members to balance different, and occasionally conflicting, missions and workloads.

**Make Expectations Explicit:** Valuation of work must be explicit and should include both traditional measures such as productivity and funding obtained, and nontraditional measures such as formation of interdisciplinary groups. Similarly, program planners would do well to provide a rubric for assessing faculty members’ publishing efforts when they are undertaken outside the home discipline and in collaboration with other faculty, their contributions as mentors to students outside their home departments, and their efforts in teaching courses that attract students from other disciplines. Appropriate rewards must also be made explicit.

**Generate New Evaluation Methodologies (Where Appropriate):** New elements of promotion and tenure guidelines must be added to include recognition and reward for contributions to interdisciplinary research and education.

Experts are in general agreement regarding the efficacy of these practices, which are suggested by federal agencies and designed to create an academic reward system more conducive to IDR. These and similar recommendations are echoed throughout the literature.48

**Interdepartmental Collaboration: Breaking Down Institutional Barriers**

The insights of university faculty and staff—as drawn from the NAS survey—point toward a number of additional steps universities may take to help ensure the success of their IDR centers and projects. When asked what “one action…institutions could take that would best facilitate interdisciplinary research,” a plurality of respondents, 36%, recommended that universities, “foster a collaborative environment.”49 This is, of course, a rather vague goal that can be approached from a number of directions, many of which involve issues of resource allocation or administration that have already been touched upon. That said, administrative restructuring can take many forms and be either disruptive and radical or subtle and conservative.

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One, albeit more radical, way that program planners can overcome differences in institutional culture and foster a collaborative environment among departments is to create an entirely new organizational structure, specifically designed to facilitate IDR. Ideally, such a strategy would help to mitigate the traditional interdepartmental divisions that often plague interdisciplinary efforts by removing those departments from positions of influence. This transformation may be accomplished by instituting a “Matrix Model” organizational structure.

The NAS Matrix Model may be thought of as a set of institutional structures that are characterized by orthogonal or cross-cutting connections between and among numerous traditional academic disciplines. The NAS Committee on Facilitating IDR contrasts the Matrix Model with traditional departmental organizational structures:

An older management structure of universities is a landscape of separate components, or “silos,” with weak coupling between them. A newer structure, which can already be discerned both in the United States and abroad and which has long been evident in industry and elsewhere, is more like a matrix, in which people move freely among disciplinary departments that are bridged and linked by interdisciplinary centers, offices, programs, courses, and curricula. There are many possible forms of coupling between departments and centers, including appointments, salary lines, distribution of indirect-cost returns, teaching assignments and course-teaching credits, curricula, and degree-granting.

A matrix structure in a university might include many joint faculty appointments and PhDs granted in more than one department which would enable participants to address cross-cutting questions more easily. It might create numerous interdisciplinary courses for undergraduates, provide mentors who bridge the pertinent disciplines, and, equally important, offer faculty numerous opportunities for continuing education whereby they could add both depth and breadth of knowledge throughout their careers.50

As this description makes clear, a Matrix Model emphasizes the creation of channels for interdepartmental collaboration. The traditional university organizational model risks creating self-contained, stand-alone pillars of academic fields where, even if faculty are interested in IDR, there are few avenues for them to find collaborators from other departments and secure funding for IDR projects. In a Matrix Model of university organization, however, departments and their faculty frequently overlap and come into contact with one another at various IDR centers, through resource pooling, and by way of joint appointments. The University of Washington’s aforementioned Program on the Environment is an example of a Matrix Model organizational structure.51 Their example indicates that the Matrix Model need not

50 Ibid. P 172-3.
51 See page 9.
necessarily be applied to the entire university. Rather, it may encompass a specific set of fields, which are then encouraged to engage in IDR.

Applying a Matrix Model is one way to create an environment that is conducive to IDR. However, a total or even partial reshuffling of a university’s traditional academic structure may be a challenging task fraught with various bureaucratic obstacles and made more difficult by those who have a vested interest in the status quo. In the face of such radical structural change, universities that wish to progress towards a greater emphasis on IDR without dramatically restructuring their institutions can choose to employ only selected aspects of the Matrix Model or make other changes, more limited in scope.

One relatively gradual way that universities can promote IDR without having to drastically alter their administrative structure is by adopting innovative faculty hiring practices. Cluster hiring and co-hiring are two examples. Cluster hiring involves recruiting and hiring faculty from a wide range of academic disciplines who have an interest in a common IDR theme (e.g., climate change, biotechnology, etc). In contrast with the traditional method of hiring, where faculty are selected on an individual basis according to the needs of a single department, cluster hiring starts with an interdisciplinary research question and builds a cadre of faculty around it.

Similarly, co-hiring may allow administrators to appoint a new faculty member to both an IDR center and a traditional department, or, as another possibility, to two separate departments. In order to avoid conflict and clarify obligations, the co-hiring entities set pre-arranged guidelines for dividing teaching, funding, and research duties associated with the faculty member. Both the NSF and NAS, as well as experts in the field, recommend cluster and/or co-hiring practices, and at numerous universities, including University of Alabama, Florida State University, Rutgers University, University of Washington, Oregon State University, and University of Wisconsin, to name but a few examples, these practices are already well-established.52

Another relatively simple step universities may take to facilitate IDR is to create a pro-IDR environment by providing funding opportunities in such a way as to ensure that college deans and department heads are open to pursuing IDR opportunities. Often, the NAS Committee writes, “deans, department chairs, and other administrators are rewarded for strengthening their own departments, not for building links to others.” In order to prevent or overcome this departmental insularity, “institutions can reward [college and department] leaders for initiating interdisciplinary programs and can provide incentives for departments to share

52 Ibid. P 100.
indirect cost revenues, seed money, course-credit assignments, intellectual property, space, personnel, and other resources.”53

Finally, something as simple as providing public spaces for informal meetings among faculty of various departments may be instrumental in fostering the interpersonal relationships that are critical to effective IDR collaboration. Borrego finds that many of the IDR collaborations between engineers and social scientists that she examines begin as “serendipitous” informal encounters.54 Part of creating a culture of interdisciplinarity, it seems, involves promoting a sense of community among faculty members. This may entail establishing informal forums, were faculty and graduate students may discuss interdisciplinary work, or simply creating common spaces where faculty can mingle. For example, the NAS Committee points out that

...several academic institutions have designed research centers with architectural features that promote collaboration, from cafeterias to shared laboratory space. As one director emphasized, “The last thing that I am going to shut down in my building is the cafeteria. It is tremendously important to bring people out of their buildings, out of their offices, out of their labs, and into a common space, and then they start talking.”55

Simple informal methods such as these may create the spark that leads to the next big IDR project on a university campus. By encouraging and providing settings for informal faculty interaction, universities demonstrate that commitment to IDR is part of their institutional culture and not merely a component of their strategic plans.

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55 Ibid. P 94.
Section 3: Evaluation

In this final section of the report, we explore the methods by which program planners and administrators can evaluate their IDR efforts with regard to success, adherence to mission, and the potential for continued funding. Specifically, we provide recommendations for establishing effective methods for evaluating IDR centers/projects, associated faculty, and the academic work produced. As opposed to traditional academic disciplines, where long-established and generally agreed upon methods of evaluation exist, the novelty of IDR and the fact that it necessarily crosses traditional disciplinary boundaries makes it difficult to evaluate using existing methods.

IDR centers and projects break the mold of traditional academic institutional structures, and as a result, they are not easily judged according to extant discipline-base criteria and require new forms of evaluation. Interdisciplinary researchers themselves are also not easily evaluated. Nevertheless, like researchers in traditional academic disciplines, interdisciplinary researchers must be held accountable to university administrators and leadership faculty, in order to ensure that they maintain high professional standards and produce quality work. This section addresses these challenges and describes potential solutions.

Evaluating Centers/Projects

The NAS Committee on IDR survey asked respondents to indicate by what means their universities’ IDR programs are evaluated. The most commonly cited evaluative methods are via internal committee (63% of responding faculty and staff, and 71% of provosts), external visiting committee (55% and 86%, respectively), informal feedback (52% and 56%, respectively), and principle investigator assessment (48% and 45%, respectively). These four evaluative methods are, in all probability, similar to those used for assessing traditional programs. The important aspect of evaluating IDR, then, is not necessarily the method employed but rather the criteria by which IDR is deemed to be successful or unsuccessful.

The NAS committee recommends that university administrators and reviewing faculty evaluate IDR using criteria specifically designed to assess such activity. Specifically, the Committee recommends that IDR evaluators account for the following factors:

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Note that respondents could choose more than one evaluative method, resulting in percentage totals over 100.

57 Ibid. P 168.
Recommended Criteria for Evaluating IDR Centers/Projects

- **Contribution to an Emerging Field or Discipline:** The degree to which IDR contributes to the creation of an emerging field or discipline can constitute a bellwether for the relative success of an IDR program. For example, emerging IDR fields in the past have included nanoscience and nanotechnology, as well as cognitive science.

- **Career Enhancement and Teaching Effectiveness:** Evaluators would do well to know how effectively an IDR program contributes to the training of students and enhances the careers of researchers in ways that surpass the results expected from disciplinary research. Potential criteria for measuring success might include employment in a broader array of positions, more rapid progress in gaining tenure and other goals, and greater numbers of speaking invitations.

- **Practical, Mission-Oriented Results:** Whether or not the research undertaken by an IDR center leads to practical answers to societal questions can be an important criterion for assessment. For example, an IDR effort to reduce hunger should produce some measurable progress toward that goal. The same IDR program might produce additional outcomes of value, including basic research, that were not expected.

- **Change in Publication or Research Habits:** Looking at the work generated by faculty members in an IDR program, evaluators may in some cases seek evidence that its participants have demonstrated an expanded research vocabulary and an enhanced ability to work in more than one discipline. This could be evidenced in a number of ways, including expanded publication efforts in new fields, a broader range of conferences attended, and an altered approach to the researcher’s home discipline.

- **Measurable Increase in Institutional Prestige:** The extent to which IDR activities, institutes, or centers enhance the reputation of the host institutions should be some indication of their success. Reputation can be measured via research funding, external recognition of IDR leadership, awards, and recognition of participants in the research.

- **Productivity Relative to a Time Horizon:** The long-term productivity of a program, as well as its progress toward research and educational goals, should be taken into account on a recurring basis. Naturally, not all initiatives will have the same lifetime, and the use of “sunset” provisions should be considered in the planning of IDR centers and programs.

- **Successful Research within the Involved Departments:** Program planners should not wholly neglect traditional metrics such as research and publication within existing fields. Measures of research success include conference presentations, patents awarded, and publication in peer-reviewed journals.
In addition to these criteria, a further and more general indicator of IDR success is student enrollment in courses and majors offered through IDR centers. As discussed in the overview section of this report, undergraduate students have demonstrated a keen interest in courses that are designed to address complex interdisciplinary problems such as climate change and economic development. To determine if their IDR programs are successfully attracting students, evaluators might ask the following questions:58

- Are interdisciplinary courses attracting a greater proportion of the general student population to science courses?
- Are interdisciplinary courses and programs attracting a new or different mix of students to careers in science?
- Are interdisciplinary courses effective in instilling scientific and technologic literacy and awareness of the roles of science and technology in modern life?

The current evidence suggests that universities have been adopting several of these recommended evaluation strategies. The NAS Committee’s survey asked respondents to identify the criteria by which their universities judge an IDR center or project’s success. By a large margin, the most commonly cited criterion was a center’s “level of (or potential for) scientific discovery or innovation” (cited by 71% of faculty and staff, and 85% of provosts). Other factors that were rated as important indicators of success include: increasing research funding, enhancing graduate or undergraduate experience, increasing the ability to attract outstanding faculty or postdoctoral scholars, and the societal relevance of the problem being addressed.59

Evaluating Faculty

Similar to IDR centers/projects, evaluating IDR faculty poses unique challenges and requires innovative solutions. As discussed in the previous section, co-hiring/jointly appointing faculty is a commonly employed and recommended strategy for facilitating IDR. As most co-hired faculty receive a portion of their salary from each of the hiring departments, this can create a sense of mutual obligation on the part of the faculty member, on the one hand, and the hiring departments, on the other. However, given the difficulty of assessing IDR work and the fact that the lengthy start-up times associated with IDR may lead to less quantifiable output than is typical for a single discipline researcher, an IDR faculty member may find him or herself “serving two masters and satisfying neither.”60

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58 Ibid. P 169.
59 Ibid. P 269.
60 Ibid. P 69-70.
To address the potential difficulty of evaluating co-hired and other IDR faculty, the NAS Committee on IDR suggests that the following questions be used to create a framework for assessing IDR faculty. We have outlined them under a number of headings (shown in boldface) that best correspond to each question’s root concern.

_Evaluative Questions for IDR Faculty_

- **Engagement with Relevant Fields:** Are faculty members conducting interdisciplinary work of high quality and reporting on it in leading journals or conferences?

- **Interdisciplinarity of Work:** Are they working on topics that they might not otherwise be able to address in their original discipline?
  - Have they extended their expertise in new directions?
  - Have they participated in establishing new subfields?
  - Do they take part in multidisciplinary advisory or review groups?
  - Have they been invited to present work in venues outside their discipline (an interdisciplinary mathematician, for example, invited to give a presentation to a biology department or at a biological professional society)?

- **Intellectual Collaboration:** Do they include students or faculty from other disciplines in their own research work?

- **Interdisciplinary Teaching:** Are their students successfully merging disciplines?

- **Evaluation History:** Have they been evaluated at their own institution by a multidisciplinary review group?
  - Have they achieved recognition, such as awards and lectureships, for IDR or from another professional society outside their own field?

The University of Southern California provides an excellent example of an institution that has adapted its faculty evaluation methods to account for IDR efforts. USC’s official promotions and review guidelines—as well as the provost’s accompanying cover letter—explicitly draw attention to the importance of accurately evaluating faculty members’ interdisciplinary work. The guidelines state that:

> If a candidate’s scholarship is interdisciplinary, the department and school should take special care to evaluate the work properly. If work does not match the departments’ priorities, but does further the school or University policies, that should be explained. The evaluation of quality and quantity should be distinguished from discussion of how the work fits strategies for

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61 Ibid. P 162.
excellence. For interdisciplinary scholarship, the lists of external referees should include experts from the other discipline, as well as experts in the individual’s own type of interdisciplinary scholarship.62

Whenever possible, institutions conducting IDR initiatives will want to have their own set of evaluative guidelines implemented well in advance.

**Evaluating Academic Work**

The recommendations listed above may prove to be effective strategies for adapting a university’s evaluation and accountability procedures to more accurately assess the success of IDR centers and researchers. However, in order to obtain a truly accurate assessment of the quality of IDR centers’ research output and the associated faculty’s academic work, universities need a set of standards by which to judge interdisciplinary academic outcomes. Since scholarly contributions to their respective fields collectively constitute a major criteria for evaluating faculty success, the parent university’s capacity to effectively review the academic quality of its IDR efforts is one of the most basic standards of assessment.

As has been indicated throughout this report, evaluating IDR work can be a challenge. Mansilla and Gardner’s (2003) paper, “Assessing Interdisciplinary Work at the Frontier: An Empirical Exploration of ‘Symptoms of Quality,’” addresses this concern and provides a framework for evaluating interdisciplinary academic output. Upon interviewing a total of 60 researchers at six premier IDR institutes, they found that researchers identified three distinct aspects of the challenge of evaluating IDR work:

First, [respondents] noted that disciplines themselves bring a variety of, often conflicting, standards of validation to the interdisciplinary meeting ground. Second, our subjects pointed to a lack of conceptual clarity about the nature of interdisciplinary work and its assessment, recognizing the need for a more systematic reflection in this regard. Third, they emphasized that in highly innovative work where novel territories are charted and few precedents are available, developing validation criteria is part of the inquiry process itself.63

In the face of these difficulties, researchers commonly resorted to indirect or “field-based” measures of quality. These measures are essentially the same as those which are commonly used to assess the quality and significance of traditional single discipline work, but in this context they are adapted to judge IDR.64 The list below highlights major strategies of indirect quality assessment for academic work.

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62 Ibid. P 103.
64 Ibid. P 4.
Indirect Measures of Quality

- **Quantifiable Results:** This metric includes easily observed criteria such as the number of accepted patents, publications, devices, and citations stemming from the work.

- **Institutional Prestige:** The quality of academic work can be indirectly associated with the reputations of the universities, funding agencies, and journals in which it is placed. Additionally, work that captures public attention in the form of press coverage or the production of consumer goods should be noted even though it is not purely academic in nature.

- **Public Opinion:** This metric is broadly related to matters of Institutional Prestige, but focuses more on the approval of peers and a broader community, both of which are difficult to quantify.

Indicators such as these pay no regard to the actual content of the work. Instead, these measures are based on the evaluative consensus of experts in the relevant fields, which is represented by easily quantifiable data whenever possible. Indeed, these indirect measures are essentially passive: they allow evaluators and peers to pass judgment on interdisciplinary work simply by taking stock of how organizations and individuals have responded to it, through publications, citations, and grant awards. As such, indirect measures provide no insight into what inherent qualities of the work lead to a high number of publications, citations, and grant awards; they cannot judge the “epistemological” quality of interdisciplinary academic work.

The indirect measures listed above only serve to approximate academic quality using measures available to non-experts in the field. Based upon their discussions with researchers, Mansilla and Gardner propose three epistemological indicators of quality IDR work.65

Epistemological Measures of Quality

- **Consistency with Relevant Disciplinary Antecedents:** This metric studies the way in which the work in question stands vis-à-vis what researchers know and find tenable in the disciplines involved. In other words, would the relevant components of an interdisciplinary project withstand the scrutiny of scholars working purely in their originating disciplines?

- **Balance in Weaving Together Perspectives:** Evaluators may ask whether or not the work stands together as a generative and coherent whole and, in a related vein, whether or not the disciplines studied have been given sufficient weight.

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65 Ibid. P. 5.
Effectiveness in Advancing Understanding: Generally, interdisciplinary academic work should be judged with regard to specific goals. Thus, the way in which the integration of disciplines advances the goals that researchers set for their pursuits is perhaps the most substantive question to be asked during the assessment process.

To summarize Mansilla and Gardner, there are three major values that should form the basis of any assessment of IDR. These are consistency, balance, and progress relative to a goal. IDR work may be called consistent when it accords with the major findings and research trends within each of the disciplines it encompasses and does not run counter to generally accepted standards. Balance involves maintaining an even perspective in the work. Academic output that one-sidedly examines an issue in the field of biology from the point of view of a sociologist, for example, would not qualify as balanced interdisciplinary work because it does not substantively engage the other field. Finally, in addition to being consistent and balanced, effective IDR work makes measureable progress toward the project’s stated goals. Evaluating interdisciplinary academic work according to these three epistemological criteria focuses the question on the content of the material, as opposed to indirect measures which merely reflect the work’s context.
Key Findings

This report has examined the likely future of IDR programs at American universities, as well as best practices in Funding, Organizing, and Evaluating IDR projects. We conclude our investigation by summarizing our findings.

Future Development Prospects and Nomenclature for IDR

We have good reason to believe that factors such as the inherent complexity of nature and society and the growing focus on problems—such as poverty or global warming—rather than specific disciplines among students are increasingly prompting universities and funding agencies to consider IDR. At present, IDR is novel enough that a commonly accepted norm for distinguishing IDR institutes from IDR centers has yet to be established. It appears that aesthetic considerations predominate.

Funding Practices for IDR

The majority of university grants allocated as “seed money” for IDR efforts range from $10,000 to $50,000 and are sustained for either one or two years. Since outside funding can help to offset the cost of founding and sustaining an IDR center, we have studied strategies for gaining such grants, particularly from government agencies. The data suggest that in an increasingly competitive market, grant proposals with multiple primary investigators are more likely to receive federal funding than those listing a single primary investigator. Proposals by experienced senior-level faculty are also more likely to be successful. Finally, Purdue University’s interdisciplinary research entity (Discover Park) demonstrates that investing in state-of-the-art facilities and equipment can, ultimately, pay off in the form of increased external funding and a greater capacity to attract research talent.

Organization and Management of IDR

In order to overcome the organizational and management challenges posed by IDR, Hanover has identified several expert-recommended strategies. Perhaps most importantly, universities are urged to revise their academic rewards systems to more accurately account for and incentivize IDR. Additionally, universities can employ a number of strategies in order to break down institutional barriers and foster interdepartmental collaboration. Adopting a Matrix Model of institutional arrangement is one comprehensive option. More subtly, universities may simply adapt their hiring practices in order to facilitate IDR. Cluster hiring and co-hiring are examples of effective and popular methods that encourage IDR growth.

In order to make such revisions to hiring and promotion practices, universities must ensure that college deans and department heads are favorably disposed towards IDR. Moreover, efforts to reform a university’s administrative structure and garner faculty
and administrative support for IDR projects may not result in any positive changes if the facilities necessary to support these activities are lacking.

**Evaluating IDR**

Section 3 of this report elucidates methods for effectively evaluating IDR center/projects, associated faculty, and academic work. In reviewing IDR centers/projects, experts recommend that universities avoid the temptation of using the same standards employed to evaluate traditional disciplinary work. Instead, they suggest judging an IDR center or project’s success according to a set of IDR specific criteria.

These criteria can include undergraduate student interest in courses and majors associated with the IDR center, as well as numerous other mission related metrics like productivity relative to the project’s duration, products produced or patents issued, enhanced teaching and research performance across disciplines among participating faculty, and improvements in institutional prestige due to the IDR center’s activities.

Since faculty and staff from various departments comprise any IDR effort, the methods of evaluating individual participants broadly mirror those used to assess IDR projects as a whole. Research presented, courses taught, students engaged, patents issued, and performance within their respective disciplines and abroad can all be employed as useful metrics for evaluating individual efforts within an IDR project.

In addition to studying an IDR project as a whole and assessing involved faculty on an individual basis, program planners should also account for the academic work produced by those scholars, since this is in many ways the basis for evaluation at the program and personnel levels. The NAS discusses two methods for evaluating academic work—indirect and epistemological. The former looks at easily recognizable, usually quantifiable indicators like publications, institutional prestige, and public opinion to see how the work is perceived and, thus, whether or not it is taken seriously in academia and abroad. The epistemological approach requires reviewers to have a substantial knowledge of at least one of the disciplines engaged in the work because it deals with issues such as: whether or not the output is truly interdisciplinary and does justice to other fields (consistency), whether or not it truly engages multiple fields (balance), and its overall impact, or effectiveness, in propagating interdisciplinary knowledge (progress).
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