RESEARCH MANAGEMENT REVIEW

The Journal of the
National Council of University Research Administrators

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Editor's Preface

For many of us, research administration is a collage of responsibilities, expectations, and involvements reflecting the culture and organization of the institution. Descriptors which come to mind for the research administrator include expediter, communicator, mediator, translator, counselor, and sometimes, strictly observer. Occasionally the role is rule maker, enforcer, and messenger (of both good and bad news). We have internal duties, with eyes to the office for policy and process; we have campus constituency roles, offering services to faculty and staff with specific or general involvement with sponsored programs and the advancement of scholarship and research; and frequently, we have responsibilities off campus, as sponsor liaison.

This issue of Research Management Review exhibits some facets of a research administrator's diversity of interests. Patricia Laughlin and Anne Sigerstad offer their insight on the problems of conducting and managing interdisciplinary research, based on analysis of a survey of institutions deeply involved in interdisciplinary projects or centers. While the issues cited as critical to successful interdisciplinary research are pretty much general wisdom, the authors go on to address quite specifically how research administrators can modify current routine or traditional administrative practices to create a more supportive environment. Research administrators are encouraged to take proactive roles in generating institutional discussions and identifying constructive changes in policies and procedures.

Not infrequently, sponsored programs offices are also a locus of fellowship information, informing the community of opportunities and coordinating applications, perhaps even participating in the selection process when limited nominations or applications are allowed from the institution, Pamela Miller's review of the institutional selection process for the NEH summer stipend program features the role of the research administrator as well as an analysis of the nominative criteria at institutions that are consistently successful in the summer fellowship awards program. While quality of the faculty applicant is the critical variable in success, research administrators may want to examine their own practices in light of Dr. Miller's paper.

With the tight funding and increasingly competitive proposal pressures, the article by Linda Parker and David Clark tackling the issue of fluctuating research funding is, unfortunately, all too timely. Their article, based on a case study of two departments and NSF funding

over a six-year period, involved analysis of departmental records and interviews with faculty and staff. The authors would suggest that institutions develop more definitive contingency plans to attenuate the consequences of their dependence on the vagaries of sponsored research activities. One can't help but observe that this looks much easier in writing than it would be in practice, given the entrepreneurial organization of most universities.

The concluding article is a comparison of proposal processing forms by Leslie Olsen and Robert Beattie. The internal transmittal - no matter what euphemism or catchy acronym it travels under in the institution - is among the mundane facts of process in the sponsored programs development area and generally a source of frustration, irritation, and misunderstanding to many. The forms seem to be constantly evolving or devolving, getting more strict or being streamlined. No matter where we might be at the moment, this article will raise some questions and perhaps generate a new edition in forms for some of us.

Concluding the issue is a brief "thought piece" contributed by John Wodarski concerning the academic research community's responsibility to educate the public about the research process, technology transfer, and the transfer of innovation/creativity to the public sector through commercial development.

The special topics issue on "conflict of interest" (Fall 1989) has been very well received. Some institutions have used it as a resource for faculty/staff committees that are looking at development of or modifications in current institutional policies. Bulk rate copies are available by arrangement with the NCURA national office.

The Editor is grateful for the continuing assistance of Nancy Ingold and Melanie Oyster, and the support for this journal from the Office of Research and Graduate Studies, The Ohio State University.

Mary Ellen Sheridan
Editor
July, 1990

The Research Administrator's Role in Creating a Supportive Environment for Interdisciplinary Research

Patricia Laughlin and Anne M, H. Sigerstad

Abstract. The debate over the correct balance of single-investigator grants versus multi-investigator grants has become more public in recent months. Multi-investigator grants are becoming a larger percentage of the support for research in the United States, forcing administrators at universities to recognize the level of coordination that large interdisciplinary research centers require. This paper describes administrative issues that can arise when interdisciplinary research increases on campus. As research facilitators, university research administrators are in a position to help their institution with management adjustments that need to be made. Interdisciplinary research brings special opportunities and challenges to the campus and to our profession.

INTRODUCTION

This paper is a report of a project undertaken by the authors in 1988 in an attempt to identify the critical issues surrounding the administration of interdisciplinary research. Much information had been published prior to our undertaking the survey,[2] but the literature frequently contained reports of local, isolated situations in the form of case studies in varied settings, including industry, medical facilities, and universities. Individual articles have centered on issues such as the faculty reward system,[3] the availability of seed funding,4 the establishment of separate university-wide research units (including the criteria for review),[5], [6] [7] as well as the importance of management and leadership skills for those involved in directing interdisciplinary activities.[8]

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We became interested in the topic because of the environment at Carnegie Mellon University, where interdisciplinary research is integrated into the research and educational activities of the institution. Our premise was that Carnegie Mellon was effective in facilitating interdisciplinary research because of its size and its emphasis on strategic planning.

Strategic planning has provided an opportunity for this institution to assess its strengths and weaknesses and to capitalize on its strengths. Strategic planning also has provided a focus for communication where faculty and administrators assess programs, establish priorities, and communicate those priorities publicly to the campus through open meetings. As an institution, Carnegie Mellon has been able to capitalize on emerging funding opportunities by being able to form interdisciplinary research groups which function effectively. Faculty appointments shared across college and departmental lines is an example of a "strength" linked to improved funding opportunities.

The administrative support structure of the university is cognizant of the difficulties of fostering and encouraging interdisciplinary research, and every attempt is made to support such efforts. In talking to colleagues at other institutions, we became aware of a perception that a supportive environment does not exist at all universities and that different universities seem to have varying responses to the need to facilitate and support interdisciplinary research.

Interdisciplinary research has taken on an increasingly prominent role in scientific pursuits, and agencies are devoting more resources to funding multi-investigator grants. The participation of industry in university research also has increased the need for interdisciplinary investigations of complex problems. The current pattern of funding increases being tied to national economic issues, including competitiveness and increased productivity, also has provided a focal point for discussion of the administration of interdisciplinary research. (There are many definitions of the terms associated with research involving more than one investigator from more than one discipline. For the purpose of this paper the term **interdisciplinary** research also may refer to multidisciplinary or cross-disciplinary research.)

As research administrators take an ever-widening role in encouraging research, it is necessary to recognize barriers and issues that arise when the research is of an interdisciplinary nature. This paper explores these barriers and issues and examines what actions a research administrator might take, directly or indirectly, to encourage growth in these research areas.

In order to gather more information on the issues, incentives, and barriers to conducting and managing interdisciplinary research, the

authors conducted a survey of selected public and private universities. The survey was designed to address the issues the authors believed crucial to managing interdisciplinary research. The authors drew on the Carnegie Mellon University experience as well as the literature in formulating the survey instrument and used a delphi group to provide guidance on important areas. The survey was piloted on a group of faculty and administrators at Carnegie Mellon University, including senior administrators and faculty who are or have been instrumental in the establishment of interdisciplinary efforts.

METHODOLOGY

Thirty-one U.S. institutions were chosen, representing varying sizes of public and private universities active in interdisciplinary research and including all the institutions awarded National Science Foundation engineering research centers as of April 1988. In order to obtain differing perspectives, the survey was mailed to provosts/vice presidents for research, deans of science and engineering colleges, directors of the engineering research centers, and faculty (chosen by the provost or vice president for research).

The survey included close-ended questions with forced answers but allowed additional space for explanations or comments. This series of questions dealt with how the responding institutions manage interdisciplinary research and covered such areas as general institutional background, governance, facilities, recognition, personnel issues, and finances.

In addition, there were nine open-ended questions that asked the respondents for their perceptions of interdisciplinary research outside the confines of their institution. These questions generally dealt with incentives and barriers to interdisciplinary research and with observations of how one can encourage the success of such research.

Of the 128 surveys mailed to 31 institutions, 42 were returned (33 percent), representing 21 or 68 percent of the institutions. Multiple responses were received from 48 percent of the responding institutions. Due to the small pool of respondents, the statistical analysis is limited to distribution frequencies. Although the size of the study pool is not sufficient for generalizing the conclusions beyond this population, the authors assume that the results will have relevance at other institutions.

Five factors that impact interdisciplinary research were identified as critical: recognition of the tenure and promotion process, including the treatment of co-authored publications; availability of funding; availability of space; the mindset of the discipline; and the single-discipline orientation of most departments.

In addition, the interrelationship of these factors and others - such as leadership and encouragement by the administration, interest of the faculty, and the policies and procedures of an institution, especially those governing the start-up and review of research centers and institutes - all affect the success of interdisciplinary research. The culture of the university, its reward structure, graduate education programs, and departmental organizations also must be reviewed in assessing the status of the issues, incentives, and barriers involved in encouraging interdisciplinary research at universities.

RELEVANCE TO RESEARCH ADMINISTRATION

What does this mean for those of us who are in positions to serve faculty who are active in this type of activity? As interdisciplinary research becomes more important to our institutions, a research administrator can take actions that will assist the institution in creating a supportive environment.

Certain issues, such as the tenure and promotion process and the process of graduate student admission and support, are beyond the scope of the research administrator's responsibility and authority. These issues, while vitally important to the management of interdisciplinary research, are not ones where research administrators in a central office will have an impact, although research administrators in academic units of institutions can provide communication on some of these issues.

First and foremost among the issues within the scope of a research administrator's responsibility is the issue of the accounting systems that we use for financial reporting purposes. With competition for resources arising between traditional departments and newly created centers, the systems used to count credit must reflect both interdisciplinary and disciplinary efforts. Otherwise, disincentives will exist for faculty who participate in activities that will not result in credit to their department. The department head also faces choices between allocating resources (space, money, equipment, and personnel) to activities that will reflect departmental productivity, or to activities which may not be counted. This issue can be resolved if reporting systems are established which allow credit for nondepartmental interdisciplinary activities.

In a similar manner, payroll and accounting systems need to allow for hybrid situations, such as the occasional joint appointment between two departments across colleges. Simple issues (like the proper designation of the faculty member's mail when it is different from the administrative department that initiates the personnel paperwork) need to be addressed. To the extent that it is appropriate, research administration offices

should ask to provide input when revisions of current human resource systems are initiated or other new systems are planned.

Policies and procedures should be examined for compatibility with interdisciplinary research activities. Do they pose disincentives? Do they allow and encourage activities across departments and colleges? As an example of a disincentive, the signature process for research proposals can become burdensome with each new signature required as the project crosses departmental lines. While obtaining a few extra signatures is probably not in itself so critical as to be the deciding factor in whether or not a researcher considers doing interdisciplinary work, the ease of the administrative requirements in initiating and conducting interdisciplinary research activities can affect this decision.

Availability of funding represents an opportunity for universities, but institutional resources, including seed monies, space, and facilities, are needed to conduct interdisciplinary research. In an environment of limited resources, financial and otherwise, the identification of opportunities must be realistically balanced by assessing the tradeoffs. Research administrators can and should ask the tough question: "Will the allocation of internal dollars required to take advantage of the opportunity still make this program attractive?" Specific considerations include the cost of renovating space and cost-sharing of equipment.

The administration and the university community must recognize the tension between traditional departments and new interdisciplinary research initiatives. Which unit receives credit for an activity often drives the discretionary funding of the colleges and departments, which in turn provides faculty with seed funding. Interdisciplinary research, which is much more difficult to count under a conventional, research-volume-based formula, is dependent upon access to the resources provided.

Research administrators, especially at the director's or vice president's level, often have some input in the suggestions for new and different incentive and reward schemes on campus. Any scheme must preserve the culture of the institution while at the same time allow for interdisciplinary research. Perhaps an alternative to a research-volume-based formula might be available which would not set traditional departments in direct competition with interdisciplinary centers and institutes for discretionary resources or specific set-asides.

(Carnegie Mellon University has provided an alternative formula based on graduate tuition rebates to the department in which the student is admitted. All graduate students, even those who are working on projects in interdisciplinary research centers and institutes, are admitted to an academic department which then receives the rebate for the student. This has been a factor in helping to create a supportive

environment in which departments are not as pressured to have every research dollar directly related to their unit. College and departmental discretionary allocations are not tied to research volume, which relieves some of the tension between colleges, departments, and interdisciplinary research centers and institutes.)

One risk in the creation of large interdisciplinary university research centers or institutes can be the inability to integrate those activities within the university. A balance between the autonomy and independence of the research unit and the need for integration of that activity into the academic community has to be established and constantly reassessed. To assist in the integration, research administrators can help develop policies governing the establishment of centers or institutes and the roles they will perform.

Similarly, the creation of new interdisciplinary research centers or institutes can also mean a rise in the number of research professionals who are not tenure-track faculty. Research administrators can play a role in establishing the policies which govern classification of those individuals within the university structure. (Carnegie Mellon University has developed separate research faculty classifications which roughly parallel the professorial titles but have no provision for tenure or teaching responsibility.)

SUMMARY

Individual institutional situations and political environments will dictate the appropriate handling of interdisciplinary research. In order for interdisciplinary research to flourish, attention must be paid to the difficulties involved in administering this type of activity. Understanding what can be an incentive or a barrier for interdisciplinary research can provide research administrators with a broader ability to assist faculty efforts in increasing research activity at their institution. If politics can be defined as any attempt to influence the distribution of resources (human, capital, or otherwise), then the existence and treatment of interdisciplinary research on campus is partly a political process and should be regarded as such.

While individual faculty interest is critical in initiating interdisciplinary research activities, the availability of funding and the tone of the organizational environment also are critical factors for the success of these efforts. Research administrators, where possible, should take a proactive role in generating institutional discussions and initiating changes which will create and reinforce a positive, supportive environment.

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Nominating Successful Candidates for the NEH Summer Stipend Program: A Review of the Institutional Selection Process

Pamela E Miller

Abstract. The National Endowment for the Humanities provides support for independent study and research in the humanities for two consecutive summer months through its Summer Stipend Program. College and university faculty interested in applying for an NEH Summer Stipend are generally nominated by their institutions. Although NEH publishes criteria by which applications for Summer Stipends are judged by peer review panels, institutions of higher education are free to devise nomination procedures for evaluating prospective applicants at the institutional level. This report describes the nomination procedures used by institutions of higher education that have consistently nominated successful applicants for the NEH Summer Stipend Program. The role of the research administrator in this process is discussed.

INTRODUCTION

Through its Summer Stipend Program, the National Endowment for the Humanities supports college and university teachers and other persons working in the humanities to undertake full-time independent study and research in the humanities for two consecutive summer months. Generally, applicants teaching in colleges and universities are nominated by their institutions.

Each college and university in the United States and its territorial possessions may nominate only three applicants for the Summer Stipends competition. Of the three nominees, no more than two may hold the rank of instructor or assistant professor and no more than two may hold the rank of associate professor or professor.

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NEH publishes four criteria by which applications for Summer Stipends are judged by peer review panels. These are:

1. The quality or the promise of quality of the applicant's work.
2. The significance of the contribution that the proposed project will make to thought and knowledge in the applicant's field and to the humanities generally.
3. The conception, definition, organization, and description of the proposed project.
4. The likelihood that the applicant will complete the project.

Each institution is free to devise its own nominating procedures for evaluating prospective applicants. Despite the importance of the nomination process at the institutional level, NEH reports that no data have yet been collected on how successful applicants are nominated by institutions of higher education (J. Neville, personal communication, November 8, 1988). The purpose of this study was, therefore, to describe the nominating criteria and procedures used by institutions of higher education to nominate successful candidates for the NEH Summer Stipend Program. The role of the research administrator in this process was also examined.

METHODOLOGY

In order to identify institutions of higher education with a record of nominating successful candidates for the NEH Summer Stipend Program, a database of summer stipend recipients for 1987 and 1988 was created. The name and institutional affiliation of each recipient were obtained from information published in Humanities (1987, May/June; 1988, May/June), a bimonthly review published by the National Endowment for the Humanities.

These data were analyzed using Q&A, a database and word-processing program distributed by Symantec Corporation of Cupertino, California (Symantec Corporation, 1986). Seventy-four institutions of higher education were identified as having had successful applicants for the NEH Summer Stipend Program in both 1987 and 1988 (see table 1).

A questionnaire was then designed to obtain information on the methods and criteria used by the seventy-four institutions to select nominees for the 1988 NEH Summer Stipend Program. Specific questions focused on:

1. The most common methods used to announce the Summer Stipend Program,

Table 1

Institutions with Successful Applicants 1987 and 1988

Boston University, Boston, MA*
Bowling Green State University, Bowling Green, OH*
Brown University, Providence, RI
Bryn Mawr College, Bryn Mawr, PA*
California State University, Fullerton, CA
Carleton College, Northfield, MN
Carnegie Mellon University, Pittsburgh, PA*
Chapman College, Orange, CA
Clarkson University, Potsdam, NY
Colgate University, Hamilton, NY
College of William and Mary, Williamsburg, VA
Columbia University, New York, NY
Connecticut College, New London, CT*
Cornell University, Ithaca, NY
CUNY Research Foundation, City College, New York, NY
CUNY Research Foundation, College of Staten Island, NY':
Duke University, Durham, NC*
Georgetown University, Washington, DC*
Harvard University, Harvard, MA
Johns Hopkins University, Baltimore, MD
Louisiana State University & A&M College, Baton Rouge, LA
Miami University, Oxford, OH*
Mount Holyoke College, South Hadley, MA
New School for Social Research, New York, NY
New York University, New York, NY"
North Carolina State University, Raleigh, NC
Northern Illinois University, De Kalb, IL*
Oberlin College, Oberlin, OH"
Ohio State University, Columbus, OH
Oregon State University Foundation, Corvallis, OR*
Pennsylvania State University, University Park, PA*
Purdue University, West Lafayette, IN*
Rhode Island College, Providence, RI
San Francisco State University, San Francisco, CA*
Stanford University, Stanford, CA
SUNY Research Foundation, College at Buffalo, NY
Swarthmore College, Swarthmore, PA
Syracuse University, Syracuse, NY*
Texas A&M University, College Station, TX
Tufts University, Medford, MA
Tulane University, New Orleans, LA*
University of Arizona, Tucson, AZ*
University of Arkansas, Fayetteville, AR
University of California, Berkeley, CA
University of California, Irvine, CA
University of California, Los Angeles, CA*
University of California, Santa Barbara, CA'"
University of California, Santa Cruz, CA*
University of Florida, Gainesville, FL
University of Houston, Houston, TX*
University of Iowa, Iowa City, IA
University of Kentucky, Lexington, KY
University of Maine, Orono, ME
University of Maryland, College Park, MD
University of Miami, Coral Gables, FL
University of Minnesota, St. Paul, MN*
University of Nebraska, Lincoln, NE
University of North Carolina, Chapel Hill, NC
University of North Carolina, Greensboro, NC*
University of Oregon, Eugene, OR*
University of Pittsburgh, Pittsburgh, PA*
University of Puget Sound, Tacoma, WA*
University of Southern California, Los Angeles, CA
University of Texas, Austin, TX
University of Tulsa, Tulsa, OK*
University of Virginia, Charlottesville, VA
Virginia Polytechnic Institute & State University, Blacksburg, VA*
Washington University, St. Louis, MO*
Wellesley College, Wellesley, MA*
Wells College, Aurora, NY
Wesleyan University, Middletown, CT*
Western Illinois University, Macomb, IL*
Western Michigan University, Kalamazoo, MI*
Yale University, New Haven, CT*

*'Returned completed questionnaire

2. The average number of individuals involved in evaluating applications at the institutional level,
3. The qualifications of the individuals involved in the evaluation process,
4. The average number of proposals reviewed,
5. The criteria used to evaluate proposals,
6. The extent to which preference was given to junior or senior faculty and the reasons for this preference,
7. The types of proposal improvements suggested to nominees prior to submission of proposals to NEH and,
8. The responsibilities of research administrators in the nomination process.

The questionnaire was mailed on March 15, 1989, to one contact person at each of the seventy-four institutions. A cover letter from the researcher explaining the purpose of the study and a letter of support from the National Endowment for the Humanities accompanied the questionnaire. The cover letter indicated that all responses to the questionnaire would be confidential and that data would be reported in aggregate form.

Contact persons were identified by consulting the 1988 membership directories of the National Council of University Research Administrators and the Society for Research Administrators. Sixty-five research administrators were identified in this manner. Questionnaires were mailed to the dean of the college of liberal arts at institutions without an NCURA or SRA affiliation (n=9). These institutions received a modified version of the questionnaire which did not request information on the role of the research administrator in this process. A follow-up letter and duplicate questionnaire were sent to contact people who had not responded to the initial survey by the fifth week of the study.

RESULTS

Thirty-nine institutions of higher education returned questionnaires between March 27 and June 1, 1989. Seventy-eight percent of the institutions without an SRA or NCURA affiliation responded to the survey. Forty-nine percent of the research administrators returned the questionnaire. The response rate for the total sample was 52 percent.

Three of the thirty-nine responding institutions indicated that a committee was not used to nominate applicants for the NEH Summer Stipend Program at their institution. These institutions did not complete the questionnaire.

Other questionnaires were returned partially complete. In order to include data from these questionnaires in the analysis it was necessary to calculate percentages based on the number of responses to each question rather than the total number of questionnaires returned (see table 2).

Table 2

NEH Summer Stipend

	#	%	n
1. Methods of dissemination			
a. Campus newsletter	21	60	36
b. Special fliers and/or posters	23	64	36
c. Personal contact by chairperson/dean	19	54	36
2. Formal preference for junior or senior faculty			
a. No preference	28	78	36
b. Preference given to junior faculty	7	20	36
c. Preference given to senior faculty	0	0	36
3. Type of proposal improvements			
a. Stylistic/grammatical	29	81	36
b. Concept	15	43	36
c. Methodology	13	37	36
4. Responsibilities of research administrators			
a. Dissemination of information	31	98	32
b. Selection of nominees	24	80	30
c. Submission of applications	21	70	30

	×	Range	n
5. Average number of reviewers	4.97	2–12	34
6. Average number of proposals reviewed	7.78	1–46	36

	%	n
7. Reviewers involved in study of humanities	73	32
8. Reviewers with previous NEH support	45	29
9. Reviewers with experience on NEH review panel	38	27
10. Repeat reviewers	53	33

Thirty-six questionnaires provided information on methods used to disseminate information on the Summer Stipend Program. The most common methods cited were special fliers and posters (64 percent), campuswide newsletters (60 percent) and personal contact by a chairperson or dean (54 percent). Personal contact by research administrators was another method mentioned by several respondents under the category "Other!'

The average number of members in a nomination committee was 4.97 with committee membership ranging from 2 to 12 members (n=34). The mean percentage of committee members personally involved in the study of the humanities was 72.9 percent (n=32). Forty-five percent of the committee members had been supported by NEH in the past (n=29). Thirty-eight percent had previously been asked to review proposals for NEH (n=27). Over half (53 percent) of committee members had been involved in the selection of nominees for both 1987 and 1988 (n=33). The average number of proposals reviewed by committee members was 7.78 with a range from 1 to 46 proposals reviewed (n=36).

Thirty-six institutions responded to the question concerning the extent to which preference is given to junior or senior faculty. The vast majority of institutions (78 percent) reported that they give no formal preference to junior faculty over senior faculty members. Only 20 percent of the institutions reported giving junior faculty an advantage. Reasons for this policy included: the need for faculty development in the lower ranks and the belief that junior faculty need more support than senior faculty.

The most common type of proposal improvements suggested to faculty were stylistic/grammatical changes (81 percent; n=36). Changes in concept (43 percent) and methodology (37 percent) were suggested less often (n=36). Modifications in scope and format, strengthening the central argument of the proposal, and the clarification of summer plans for long-term projects were also cited under "Other."

The most common role played by research administration offices in the nomination process was the dissemination of information (98 percent; n=32). Eighty percent were involved in the selection process (n=30). Seventy percent submitted the applications of those faculty nominated for the NEH Summer Stipend Program to the agency (n=30). Tasks reported by research administrators under "Other" include coordination of the selection process and coordinating applications across colleges. Writing and editing of proposals was cited in only one case.

Eighteen institutions reported using the NEH criteria as the sole basis for selecting promising applicants. More specific criteria for evaluating proposals were used by approximately half of the institutions that responded to the survey. The overall quality of the proposal as well

as the significance of the topic were two of the most common criteria used. The likelihood of the project's successful completion as well as the reliability and experience of the researcher in the research area were also considered quite frequently. Recommendations by department chairpersons and deans influenced the selection of applicants in only a few of the cases reported.

DISCUSSION

The objectives of this study were to describe the process used to select nominees for the NEH Summer Stipend Program at the institutional level. The role of research administrators in this process and the specific criteria used to evaluate proposals for the Summer Stipend Program were also investigated.

The results of this study indicate that the majority of institutions of higher education that responded to this survey use a committee of some kind to review applications and to select the most promising proposals. The typical review committee is mainly comprised of individuals with training in the humanities who have had some previous success in obtaining funding from NEH. It is also fairly common for institutions of higher education to involve individuals who have had experience as reviewers for NEH. These committees appear to be formed on an ad hoc basis with slightly fewer than half the reviewers changing each year.

Some institutions of higher education, however, reported that they do not utilize a formal selection process to nominate faculty for the NEH Summer Stipend Program. For example, four universities reported such a low response to the Summer Stipend Program, during the period of interest, that there was no need for a committee selection process. One of these institutions indicated that faculty had to be actively recruited to apply for the 1988 competition.

Three other universities reported that they combine the review process for the NEH Summer Stipend Program with the review process for other institutional awards. For example, at one university, the same committee evaluated 40-50 faculty proposals and nominations for an institutional summer research grant program. From this group, nominees for the Summer Stipend Program were chosen.

The role of the research project administrator, according to the findings of this study, is quite varied. Research administrators distribute information about the program, coordinate the review process, and submit applicants' proposals. It is very rare for research administrators

to become involved in the preparation of a proposal, except to recommend stylistic and grammatical changes identified as a function of an institutional review process.

One interesting finding is that many research administrators who provide information about the Summer Stipend Program and advice about how to prepare applications also report that they review proposals and select institutional nominees. This finding suggests the possibility of the appearance of a conflict of interest.

Two universities deal with this potential problem by having one office in charge of disseminating information and giving advice about the preparation of applications and having another office that receives applications for nomination and selects nominees. Research administrators might consider this solution or be prepared to document that all potential applicants have access to the same program information and assistance in preparing proposals.

Another finding of this study is that many individuals without expertise and/or training in the humanities participate in the evaluation of applications and the selection of nominees for the Summer Stipend Program at the institutional level. NEH invites only humanists to review proposals.

Although not within the scope of the present study, it would be interesting, in the future, to identify the position titles and unique qualifications of members of institutional review committees who are not humanists and to discover on what basis these individuals review proposals. Presumably this group would include some research administrators. It would, therefore, be informative to learn to what extent research administrators who are involved in the evaluation of institutional applications possess expertise and experience in the humanities. It would be logical to assume that those research administrators with training in the humanities would assume a different role, relative to the selection of nominees, from that of research administrators without such training.

The review criteria used to select nominees for the Summer Stipend Program at the institutional level do not differ greatly from those published by NEH. Institutions of higher education base the selection of nominees primarily upon the quality of the proposal and the experience and expertise of the applicant. This finding was disappointing in that respondents did not indicate how general terms such as “quality” and “significance” were interpreted by reviewers.

This outcome provides little guidance to applicants attempting to prepare competitive proposals or to reviewers attempting to establish guidelines for selecting nominees. Without such guidelines, many junior

faculty are at a disadvantage in preparing applications for this program in that the majority of institutional review committees do not appear to give junior faculty any preference when choosing institutional nominees.

CONCLUSION

Due to the purely descriptive nature of this study, it would be inappropriate to conclude that any set of procedures and criteria used to select nominees at the institutional level will significantly influence the awarding of Summer Stipends by NEH. The quality and significance of an individual applicant's proposal will always be the most critical factor influencing the success of any given application. This study sought to describe what is currently being done at the institutional level to encourage applications and to evaluate proposals, primarily for the benefit of those research administrators responsible for carrying out this program each year at their own institution.

It was not within the scope of this study to determine if applicants from larger institutions "did better" than applicants from smaller institutions or if applicants from institutions from one area of the country were more successful than applicants from other areas of the country. Also not investigated were the comparative success rates of applicants representing each of the areas of the humanities.

In order to investigate such questions with any degree of confidence, a database comprised of both successful and unsuccessful applicants would need to be developed and submitted to statistical analysis. It is hoped that this study will provide the impetus for future study of these and other related questions.

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Departmental Responses to Fluctuation in Research Resources

Linda E. Parker and David L. Clark

Abstract. The complex relationship between academic institutions that conduct federally sponsored research and funding agencies exists amid many, and often conflicting, pressures. This article focuses on the consequences of dependence on fluctuating research funding in two departments and how they responded to them over a six-year period. In particular, it examines how the departments juggled dependence-based problems with graduate student education, instrumentation needs, grant discontinuations, faculty recruitment, and planning. The main conclusion is that the combination of institutional decentralization and the individual entrepreneur approach in academic science is maladaptive and puts a research institution in a precarious position when underlying issues related to extramural funding dependence during a period of funding fluctuations are not addressed or even acknowledged.

As anyone associated with higher education knows, federal government sponsorship of academic research has come to be a significant source of revenue for research universities and, to a lesser extent, many other institutions since the end of World War II.' While these institutions have become heavily involved in research or are seeking to increase the level of their research activities in order to achieve enhanced prestige, it is at the department level that prestige enhancement must begin.[2]

The development of research as a mission of departments in universities that have become, or are becoming, top research universities is fundamental to the evolution of departmental structure and power.

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Decades of increasing federal support to individual researchers through their departments hastened decentralization within individual institutions. In the process, some departments became more independent of their institutional administrations and increasingly dependent upon financial support provided by external funding sources.[3]

The fact that annual research funding levels at federal agencies have become unpredictable in recent years is a matter of concern to faculty members conducting sponsored research, their department chairpersons, and university administrators at institutions engaging in significant levels of research activity. This has resulted in increased uncertainty about obtaining research support on the part of researchers and administrators, as well as uncertainty about how much income could be obtained for research-related activities, such as graduate education.

If aggregate levels of federal funding for university research are to remain an annual uncertainty, universities with research missions that are supported significantly by the federal government should be aware of short-term problems that this situation creates for institutions. Further, academic administrators at these universities will need to consider long-term strategies to insure that significant reductions in aggregate federal funding levels will not seriously threaten their institution's research mission.

The study described in this article, focusing on two science departments at an institution with the Carnegie Classification Research Universities I, investigated the consequences of dependence on fluctuating external research sponsorship and how the departments responded. Recognizing that department-level research management is not always closely linked to university-level research management, this article shares information with university-level research managers about what happened at the departmental level at one institution over a six-year period.

DEPARTMENTS AND ACADEMIC PRESTIGE

Top research universities have been identified in numerous ways by different organizations and individuals. The Carnegie Foundation's4 classification system and the Higher Education General Information Survey (HEGIS)[5] system are but two examples of systems that gauge institutional ranking, or prestige, on the basis of research productivity indicators.

Numerous approaches have been devised to address the concept of departmental prestige. Garvin asserted that prestige is highly correlated with various objective measures of quality, such as those traditionally used to develop prestige rankings. Departmental prestige emanates from

the research endeavors of faculty members and graduate program strength. Departments at institutions with a research focus engage in a variety of activities intended to increase their prestige relative to departments in the same discipline.[2]

In his 1985 matrix model of the American research university, Alpert expressed concern that reliance on achieving high departmental ratings "has served to impose the values and the mission of the outstanding research universities on most of the other colleges and universities" (p. 276). The single measure of institutional quality assures that institutions of lesser repute that are determined to improve their status will try to increase their faculty's disciplinary research commitment. The result is a further increase in competition for limited research sponsorship and little incentive to pursue investigation in new areas of research.[3]

McGuire, Richman, Daly, and Jorjani investigated a variety of factors that could affect the production of reputation in terms of economic efficiency. They found that, relative to expense and ease of implementation, it was better to pursue a strategy that was designed to achieve a relatively equal distribution of reputation or quality among departments within an institution, as opposed to a strategy that focused on achieving excellence in a few areas. In addition, they noted that making significant changes in reputation is expensive in terms of capital and labor and is a slower process than most researchers and administrators expect or wish.[6]

PRESTIGE AND DEPENDENCE ON FEDERAL RESEARCH SUPPORT

Federal financing of academic research creates certain situations with which departments must contend. The maintenance of departmental prestige in the face of the retirement, resignation, or death of key faculty members "may precipitate a serious decline in quality, often inducing other prominent scholars to depart as well" (p. 57).[2] Although departmental prestige enhancement is qualitatively different from prestige maintenance, institutional commitment to each endeavor is necessary, since both are ultimately designed to affect the amount of federal research support awarded to the institution. Nonetheless, enhancement and maintenance are somewhat restricted by the availability of institutional funds necessary to hire prestigious faculty and, thus, may involve importing talent at a significant price.[2,7]

According to the Commission of Colleges, even in the case of partial dependence on sponsored funding for faculty salaries or graduate student fellowship and assistantship stipends, "termination of grants and contracts

can jeopardize an entire educational program. It is also important that the institution not become dependent upon indirect cost allowances from grants and contracts to support its regular operating budget" (p. 75).[8] Similarly, Welzenbach stated that if sponsored program funds are integral to an institution's functioning, "any significant withdrawal could create substantial academic, administrative, and fiscal problems" (p. 85).[9]

The Resource Dependence Theory[10, 11] contends that an organization's activities and outcomes are determined by the specific context in which the organization is situated so that internal political processes within organizations "must attend to the demands of those in its environment that provide resources necessary and important for its continued survival" (p. 193)[11] Actors in the environment and within the organization are interdependent. If their relationships become too competitive, the survival of the organization could be threatened. Thus, in order for it to continue to operate, maintaining symbiotic relationships among the actors may be necessary.

The consequences of dependence upon federal research support are of particular interest to top research universities and those that aspire to that status because the revenue from grants and contracts supports not only research but also important programmatic activities, such as graduate education. In order to gain a deeper understanding of the consequences of such dependence and how departments and institutions approach them, this study examined the experiences of two hard-science departments at one **Research** Universities I institution with NSF funding over a six-year period. While imperus for the study came partially from the theoretical work of Garvin[2] and Pfeffer and Salancik,[10,11] the study was designed to determine how members of departments viewed the impact of fluctuations on what they could do and how they responded to dependence in the face of fluctuations.

METHOD

The study was conducted as a series of case studies and focused on NSF funding of the astronomy and physics departments at a public research university during the FY 1981-86 period. As an index of level of overall research activity, the university is categorized as **Research** Universities I according to the Carnegie classification system and is a member of the Association of American Universities (AAU). The study was restricted to NSF sponsorship to highlight the impact on departments of fluctuations in a historically important source of research funding.

Data were collected from interviews and documents. Specifically, six one-hour and six half-hour interviews were conducted with astronomy

department participants, and 19 one-hour interviews were conducted with physics department participants. Also, five cross-check interviews of varying lengths were conducted with strategically chosen university officials at the end of the data collection phase to fill in information gaps. In addition, a variety of documents were obtained from the departments and administrative offices. The departmental interviews constituted the data core for the study, while the remaining interviews and the documentary data were used to support or refute interview data relating to technical fact or to provide a context for understanding portions of the core interview data.

Faculty members without NSF funding during the period under investigation and NSF-supported researchers who were not in residence at the university when the interviews took place were excluded from the study. The pilot study had suggested that the degree of decentralization at the departmental level would make it unlikely that those without NSF funding would possess enough information about how dependence on fluctuating NSF funding affected their department to warrant including them in the study.

RESULTS

Students

Both departments were dependent upon a variety of resources for support of graduate students. While both departments relied on institutional funds for teaching assistantships and fellowships and research grants for research assistantships, the physics department had access to more sources of each kind than the astronomy department did. NSF was not the primary source of graduate student support for either department, but it did provide a significant number of summer research assistantships for physics students.

During the 1981-86 period, the physics department operated under a policy that required every research proposal to include a request for funds for at least one graduate student. The policy was linked to a departmental goal of having all students supported by research grants starting in their third year of graduate school, leaving institutional funds for support of first- and second-year students. The department operated under the premise that the more funding available to students, the more attractive its graduate program would be. Thus, the department's desire to increase the number of students on "soft money" research assistantships coincided with a desire to increase the attractiveness of the department to prospective graduate students.

Like the physics department, the astronomy department also wanted to increase the number of NSF research assistantships it had to offer to enhance its ability to attract and support students. During the 1981-86 period, the department was not successful in increasing the number of NSF positions, so no increased dependence on that source of support developed.

Dependence on grant-based positions took on significance when a proposal for renewal of funding was not awarded, in what the researchers referred to as a "discontinuation" of funding. When this occurred, students either lost their jobs, or were subsequently supported on a temporary basis by the department, while researchers lost operating funds and summer salary. From the standpoint of gaining research experience, those who lost research assistantships and had to find outside employment were at a decided disadvantage. This was particularly true when their thesis work was closely tied to the research project that did not receive new funding. From the department's standpoint, deciding whether to support students on discontinued grants was partially a function of the extent to which departmental resources had been committed for other activities.

Instrumentation

Instrumentation was of particular concern to experimentalists. As long as theorists had adequate computer access, they were generally satisfied. Experimentalists, however, needed a variety of sometimes very expensive, specialized equipment to conduct research. For them, obtaining resources to procure what they needed was critical to their productivity and therefore their ability to maintain continuous sponsorship of their research.

The success of experimental physicists and observational astronomers (the term for astronomers who do not do theoretical research) in obtaining instrumentation funds from NSF varied during the 1981-86 period. Predictably, those who were funded adequately reported no difficulty in obtaining such funds. On the other hand, those who had not been as successful indicated that NSF had not fulfilled their needs. Outstanding needs ranged from replacement of common, relatively inexpensive meters to acquisition of new, state-of-the-art instruments that had just become available to researchers.

Those who had had difficulty obtaining instrumentation funds voiced concern about the impact on their research of not working with the most appropriate equipment. While one of the consequences of using outdated instrumentation was a reduction in research efficiency, the principal concern was that the results being produced with outdated instrumentation would not be competitive during subsequent review

of their next research proposal by NSF. They perceived a direct connection between ability to obtain instrumentation funds - be it through a large proposal to NSF for a single piece of equipment or an equipment line item in a regular NSF research proposal - and future success in receiving continued research support.

Instrumentation deficiency in academia has been a widely recognized national problem for well over a decade. With this study focusing on the 1981-86 period, it was necessary to differentiate between a long standing situation and changes that occurred during the study period. In the minds of researchers with instrumentation needs, it was clear that obtaining necessary funding had become more difficult during the specified period. This heightened their concern about their ability to obtain further research funding from NSF because they perceived that their individual competitiveness was being compromised by circumstances beyond their control at a time when the amount of competition for limited resources was increasing. Researchers were concerned that, with more people applying for the same funds, they had to produce even more competitive research results in order to have their new proposals funded. A greater level of productivity had become necessary in order to ensure continued funding.

Proposals from some observational astronomers and experimental physicists were declined during the 1981-86 period when they submitted research proposals to NSF for continuation of funding. In most cases, they linked their declinations at least partially to having inadequate equipment. In addition, some instrumentation proposals were not awarded. These latter declinations caused some people to locate collaborators elsewhere in order to gain access to up-to-date instrumentation. Alternatively, others tried to make do with existing old or outdated equipment.

Facilities Renovation

During the 1981-86 period, NSF did not provide institution-based grantees with direct-cost funding for facilities renovation or construction. Instead, indirect-cost reimbursements to grantees were allowed to be used in this manner. At the university, each department chairperson with faculty members conducting sponsored research received a portion of the overhead return paid out to the institution for each grant awarded to one of his or her faculty members. These funds could be used for renovation or construction. Additional overhead money for these activities could be requested from centrally managed overhead accounts.

The physics department experienced more facilities needs during the 198146 period than the astronomy department, partially because of

the laboratory nature of a significant amount of the research conducted by physics faculty members. While the astronomy department needed more office space, there were no significant problems with the observatories. In the physics department, needs included improving the air-conditioning in one laboratory to allow increased control over temperature while conducting experiments, renovating existing laboratories for new faculty members, and adding a wing to the building, the core of which was designed before World War II.

Problems occurred when unmet facilities needs existed over a prolonged period. This was particularly true for new physics department faculty members, some of whom were in their first academic positions. They had joined the department because the recruitment package was attractive. The package included a departmental commitment to expend a specified amount of money, much of which was from indirect-cost recovery, to renovate a laboratory to the recruit's specifications and seed money to commence laboratory operations.

From the department's standpoint, the expenditure was an investment in the future capability of the researcher to obtain research sponsorship. In essence, it was an insurance policy for the department in which accrued benefits would come in the form of indirect-cost income from the researcher's grants. The researcher also viewed the renovation and seed money as critical to obtaining sponsorship, but also saw receipt of grant funding as the primary means of acquiring tenure or a promotion. Thus, if renovations for a new faculty member were not completed in a timely manner after arrival at the university, the researcher would be delayed in making the laboratory operational, which, in turn, would jeopardize his or her ability to demonstrate an adequate degree of productivity to research sponsors and tenure and promotion committees.

Inadequate research and storage space resulted in one researcher abandoning a portion of one project and delayed other projects, all of which wasted valuable time. While indirect-cost recovery funds were not expected to cover the full cost of a much-needed addition, the physics department used some of these resources to fund its construction during the 1981-86 period. In one way or another, using overhead resources to meet one large facilities need detracted from other needs.

Thus, fluctuations in indirect-cost recovery funds associated with the variable funding success of its faculty members had a direct impact on research productivity. As with instrumentation, reductions in overhead funds forced researchers to work in less than optimum research conditions. They believed that this factor compromised their research competitiveness and reduced their ability to obtain future NSF grants, which, if obtained, would contribute indirect-cost funds to the department that could be used to address facilities needs.

Proposal Declinations

From the standpoint of dependence on external resources, those who had submitted renewal proposals that were declined had to contend with a variety of consequences. Concomitantly, their departments had to address some of the same consequences because they depended on the productivity of their faculty members to support research personnel and provide indirect-cost income. Without support, researchers lost the ability to pay graduate students and postdoctoral fellows, cover the costs of conducting research, and provide themselves with a summer salary. When a researcher was discontinued by NSF, his or her department chairperson had the option of giving the researcher a nominal amount of departmental funding to support graduate students and enable a low level of research to continue. Department chairpersons dispersed the funds quietly on a first-come-first-served basis and preferred to use them for those whose operations really needed it and were likely to obtain regular research support in the near future. This bridge funding, however, caused a number of problems.

In the astronomy department, there was dissension among some faculty members because departmental funds were used to support a discontinued NSF researcher who had ceased submitting proposals. Faculty members contended that this was a misuse of the overhead return that their grants contributed to the department. In a similar vein, some physics department researchers, predominantly theorists, took issue with the way in which the same funds were dispersed in their department. Acknowledging that there was not enough money to fund all who had been discontinued, they contended that the chairpersons during the 1981-86 period had been more likely to give bridge funding to experimentalists than theorists, especially where graduate students were involved.

Researchers whose proposals for follow-on funding had been declined pursued a variety of courses in order to obtain subsequent extramural support. Some of those who had been discontinued were able eventually to obtain NSF funding because either work completed during the unfunded period or modifications to their original proposals motivated NSF to fund a subsequent proposal. Others, who had suspected that they were working in areas of decreasing interest to NSF, submitted successful proposals to other federal sponsors, such as the Air Force, the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), and the Department of Defense (DOD).

Those who were surprised by their declinations, especially when notification was received within a few weeks of when the new award would have begun, were not operationally or psychologically prepared

for the declination. Having not expected it, they had not examined the possibility of other sources of funding. Both astronomers and physicists agreed that any declination was demoralizing and could result in some faculty members stopping extramural research altogether. The astronomer who opted for the latter route was perceived by some colleagues in his department to be a drag on the department because he was receiving some of its indirect-cost recovery income as bridge funding, yet he was not seeking extramural support to contribute indirect-cost income to the department.

Faculty Recruitment

Both departments used a variety of criteria to identify researchers whom they wanted to recruit. One criterion was the potential for obtaining external support. While there was disagreement about the wisdom of seeking candidates whose research was in a "hot," highly funded area, there was no dispute about a departmental policy to hire researchers who would attract significant amounts of funding. Faculty members who were concerned about hiring people principally because they worked on hot topics feared that their department was sacrificing program balance in its pursuit of extramural income needed to support other department activities.

Planning

While both departments desired growth in the number of graduate students and faculty members and in the amount of external income, formal department-level planning was not evident. Neither long-term nor short-term plans had been devised to describe future activity mix, department size, or program balance in either department. In fact, members of both departments indicated that NSF funding fluctuations hampered their ability to do short-term planning. This caused particular problems with respect to graduate students in the physics department. Since the department was dependent upon NSF for some of its graduate student support, NSF funding fluctuations made it difficult to determine how many students the department would be able to support in a given year.

Contingency planning also was not evident. According to some faculty members, the concept was not well understood. Each department had experienced a variety of problems associated with dependence on NSF funding and had handled them on a one-by-one, piecemeal basis when they occurred. The lack of pre-existing guidelines for managing different types of situations caused friction among faculty members who perceived inequities in the way similar problems stemming from NSF funding dependence were handled.

The philosophy of dealing with problems as they occurred allowed a precarious situation to develop in the physics department. By the end of the third quarter of FY 1986, the department had either obligated or committed all of its local discretionary funding. The committed funds were tied up in a large faculty recruitment package. For the remainder of that fiscal year, no additional local resources were available for any purpose. In this situation, the absence of contingency plans caused the potential consequences of dependence on fluctuating resources to become more significant.

DISCUSSION

No significant attempts had been made at either the departmental or institutional level to address the issue of dependence on variable external funding and its consequences. Responses to consequences had not been coordinated among units. Departmental planning was not in evidence in either department. Forecasting or needs assessments had not been conducted. Contingency plans were nonexistent.

Due to the level of decentralization in the departments and their "every man for himself" approach to problem solving, no significant data were collected about the consequences of dependence. Except for one person who turned to international collaborations when his NSF proposal received a declination, researchers discussed neither sharing of personnel, equipment, and facilities, nor teamwork as means of coping with unmet needs or discontinuations that threatened their ability to compete successfully for future funding. These issues were approached in somewhat of a "head in the sand" fashion, especially by those who had experienced no problems personally. While the departments stepped in and provided bridge funding for some researchers who were declined, inadequate departmental resources precluded the existence of a safety net mechanism for moderating the effects of an unfunded period for all who were between grants. Theorists were particularly conscious of the limited supply of bridge funding, as they were rarely able to obtain any.

In an environment in which operations depend on adequate levels of resources, and the aggregate supply of resources fluctuates, preservation of operational capability requires keeping the level of vulnerability as low as possible. If a department hires faculty members on the basis of proven or potential for excellence, such a strategy ultimately contributes to the department's and individual researchers' pursuit of excellence. By underwriting the operations of excellent people and their staffs for a short time with a relatively small amount of money, a department takes an active role in preserving the competitiveness

of the faculty members in whom they have already made significant investments. In addition, graduate students are insulated from the effects of a situation over which they have no control but that could force them to leave graduate school.

The same argument for keeping vulnerability low applies at the institutional level as well. In the study, the university had no buffer policies that were designed to insulate the segments of the university most likely to be negatively affected by research funding fluctuations. As in the case of a department, the absence of planning or a strategy for dealing with significant extramural support fluctuations at the institutional level implies a narrow view of its obligation to protect its investments in research operations and personnel.

Some of the consequences of dependence were not recognized because the departments' and the institution's threshold of pain had not been reached. This occurred partly because impacts were perceived to be moderated when funding from other sources increased, although those who had experienced some negative impact were not necessarily the ones who benefited from the increases. On paper, however, funding totals would not indicate this discrepancy. By the same token, no one was consciously looking for consequences of fluctuations.

A dynamic tension between two structural factors shaped the relationships between individual researchers, their departments, and the institution. On the one hand, institutional decentralization and academic science consisting of individual entrepreneurs contributed to the perception that coordination of individuals and their responses to events was not in anyone's best interest. On the other, all individuals involved accepted the notion that sponsored research was a zero-sum game, i.e., that there were always going to be winners and losers. This did not mean, however, that, as individuals, faculty members were fatalistic about how they fared. The predominant view was that individual players were more or less responsible for how well they did, but they tended to support departmental intervention - be it for bridge funding or cost-sharing funds for instrumentation acquisition - when they saw that their prestige and competitiveness would be compromised without it.

In this study, a desire to maintain departmental research missions guided how departmental funds were spent. Nonetheless, the absence of a publicly articulated strategy for dispensing the funds caused conflict among investigators, as well as between researchers and department chairpersons, regarding how well departmental funds were being spent. The zero-sum nature of the sponsored research world caused players to have differing ideas about the best strategies for winning and how to respond to losing, depending on their position on the playing field.

This view of a zero-sum game does not preclude the existence of great departments. It does suggest asking if they approach maintaining their research mission in a different manner. One might hypothesize from this study that great departments have a different view about the role of the department in protecting its investments in excellent people and excellent research as well as the extent to which they engage in planning and develop strategies to maintain, as well as enhance, their excellence beyond hiring top-notch people.

The combination of institutional decentralization and the notion of the scientist as an individual entrepreneur was detrimental to the maintenance of the academic research enterprise as well as institutional and departmental research missions. Researchers sought to increase their dependence on fluctuating third-party research sponsorship for the sake of their own competitiveness and reputation. Departmental and institutional dependence on individual researchers' entrepreneurship to maintain research missions created situations that collectively threatened the departmental research and graduate education activities.

Ironically, the development of departmental autonomy relative to the institution and individual investigator autonomy relative to his or her department that came to characterize decentralized research institutions evolved because of the growth of federal sponsorship of research in the decades immediately following World War II (Alpert, 1985). This study supports Alpert's contention that decentralization is maladaptive at the institutional level, but for different reasons. Whereas Alpert identified the institutional budget allocation process as the target of impact, this study indicates that the capacity to conduct research and provide graduate education are also impact areas.

Whether the model described by Alpert was ever appropriate is debatable. It is clear, however, that under conditions of dependence on fluctuating resources, it is dysfunctional, encourages a false sense of security, and places institutions that operate according to it in position to receive shock waves if current levels of federal research support were reduced significantly as a part of federal deficit reduction measures. The result would be impairment of the research and graduate education capacity across the academic research enterprise for years to come.

RECOMMENDATIONS

Until research universities adopt policies and procedures that address the consequences of their dependence on fluctuating research sponsorship, they will continue to subject themselves and the academic research enterprise to an unacceptable and unnecessary level of risk.

Developing appropriate policies means examining existing ones for relevance, replacing ineffective and ill-conceived ones, and devising new ones that fill needs not addressed by existing policies. An example of the former would be assessing the wisdom of a policy that requires graduate students to have extramural support by their third year of study at a time when continued funding of the underlying research grants is not assured.

Conversely, existing policies did not adequately address many researchers' instrumentation needs and gaps in project funding. Reexamining the use of indirect-cost recovery funds could lead to abandoning existing policies and creating two new ones. The first could provide small-scale incentive funds for novel solutions to instrumentation problems (e.g., borrowing, collaborating, developing creative make-shift improvements), while the second might be a policy requiring that a predetermined portion of all departmental and institutional overhead return accounts be set aside for contingency use only. This could be handled in a number of ways. For example, the institution could require each department to have such a reserve, but leave it to individual department chairs and their faculties to determine the actual size and instances in which it could be used. While establishing policies that cushion an institution from extramural research support fluctuations need not involve making revolutionary changes, the advantages of having such policies in place clearly exceed the risks of operating without them.

The focus of this study was on those who were directly involved with NSF funding in the two departments. Excluding faculty members who did not receive NSF funding during the 1981-86 period necessarily affected the results. For example, it is possible that some former NSF grantees chose to seek sponsorship from other sources instead of NSF because they did not want to be subjected to the uncertainties of reliance on that agency's support. This response to funding fluctuations would not have been included. Further, it would be interesting to see whether non-NSF grantees were more or less accurate in their perception of their department's funding trends.

In 1990, there is every reason to believe that fluctuations in federal support for academic research will continue to be the rule, rather than the exception, for the foreseeable future. This, combined with NSF research proposals being awarded at a rate of barely one in three since 1985,[12] suggests that the major issues presented in this paper, e.g., how departments and individual researchers respond to declinations and inadequate facilities and equipment, will continue to be of concern. In order to enable departmental and institutional decision makers to protect their investments by developing sound means of dealing with the current climate of uncertainty, much more information is needed.

First, comparative studies of departments of different strength in the same discipline would illuminate not only situation-specific considerations, but also transferable approaches to dealing with current uncertainties. Among other things, this type of study would clarify the extent to which solutions that are appropriate for great departments are also applicable for other departments, and vice versa. Second, it would be interesting to know whether differences in review processes, proposal success rates, grant sizes, and grant durations associated with other federal agencies result in different problems for departments and institutions when overall funding fluctuates. Finally, it would be valuable to investigate institutions that have recently increased their level of sponsored research to see if they approach problems stemming from dependence on fluctuating resources differently from institutions that are not "moving up" the ladder. This type of work could illuminate different balances between decentralization and institutional coordination.

Clearly, there is much to learn in this area and many difficult issues to consider. In gathering and sharing information about lessons learned, it may be possible to shift some elements of the zero-sum game so that they operate in a win-win environment.

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A Comparison of Proposal Processing Forms and Databases at Twelve Universities'

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Abstract. This study compares the tracking of proposals through the administrative offices of twelve research universities. It demonstrates that these universities vary widely in the amount and type of data they collect. Many do not collect predicted data - including the number of students working on a project or the impact of a project on the university's space, computer facilities, or staffing - or much data of national interest such as the affirmative action status (sex/race) of the investigators or the use of chemical carcinogens, radioisotopes, and other hazardous substances. Most do not require prior approvals of the use of human subjects, recombinant DNA, chemical carcinogens, biological hazards, radioactive substances, and other hazards, although many do require notification of use. Only one requires a certification statement about integrity of scholarship.

INTRODUCTION

From 1986 to 1989, the National Science Foundation funded research at the University of Michigan and Carnegie Mellon University for the design of EXPRESS (Experimental Research in Electronic Submission), a computer-based system for the on-line creation, processing, and review of complex scientific and technical documents.[2] The test case for the system was the creation and processing of NSF proposals in a totally electronic medium. As proposed and now developed, EXPRES allows collaboration among geographically separated colleagues; the integration in a single editor of text, mathematical expressions, line drawings, bit maps, spreadsheets, and other "objects" which need to be incorporated

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into complex documents; and a demonstration of the interchange of editable documents among different hardware and software environments.

Part of EXPRES involved the review and processing of proposals through university administrative offices. Thus, a study was conducted to establish a "baseline" description of the current practice in proposal submission, including for each university what data items are required on the approval forms, what approvals are required, and what data elements are entered into the sponsored projects data files.[3] The study involved an analysis of the transmittal forms and databases of the twelve research universities cooperating with the EXPRES project. This article presents the results of the analysis and from these constructs a "model" proposal processing form.

While the study had a purpose for EXPRES, the results may also prove informative to the wider community of research administrators. Almost every university requires some approvals before a faculty member may submit a proposal to an external agency. These approvals are usually obtained on a form[4] that is transmitted from the faculty member to that person's department, then to a college dean, and finally to the university administration (the Sponsored Projects Office and university officers). The form is also used by the Sponsored Projects Office to gather information which is used to monitor proposal and award activity. In the course of analyzing the data, we were able to compare the tracking of information about issues of interest to research administrators: administrative issues as well as several issues of current national interest such as the ethical behavior of professionals, affirmative action, handling and disposal of hazardous materials, and the impact of research activities on the facilities and staff at the universities.

METHOD

There were twelve research universities selected, to participate in this project: Berkeley, Chicago, Illinois, Indiana, Iowa, Michigan, Michigan State, Minnesota, Northwestern, Ohio State, Purdue, and Wisconsin. They were selected because their size and volume of research made them among the most demanding examples of the complexity associated with processing university proposals and research projects. Coincidentally, they illustrated a wide range of computerization with the research offices and included two private institutions. In conducting the analysis, we:

1. obtained from each university all forms and publications used for proposal processing and database entry during fiscal years 1986 and 1987,

2. coded and classified the various components of the forms into 115 elements, preserving the specific language of each form, and
3. regrouped the components of the forms to those categories presented in the following section. At this stage, we grouped synonymous terms under a single term, e.g., in dealing with clearances for the use of laboratory animals, "vertebrate animals," "warm-blooded animals," "lab animals," and "animals" are all discussed as "laboratory animals."

RESULTS OF ANALYSIS

The data from the twelve universities were grouped into six major categories: Proposal Identification Information, Processing Dates, Clearances and Special Facilities Use, Authorizations and Certifications, Budget Information, and Participant Counts. The results for each group are presented below.

Proposal identification Information

All twelve universities tracked five groups of elements related to proposal identification: identification numbers and project director (PD) or principal investigator (PI) information (table l), proposal type, title and

Table 1
Proposal Identification Information Tracked by Twelve Universities

Identification Element	# of Universities
Identification Numbers	
university identification #	11
in database (10 different names)	11
on proposal form	9
sponsor's ID # (RFP #)	
other numbers (e.g., NACUBO function #)	3
Principal Investigator, Project Director	
name	12
rank and title	8
department or administrative unit	10
code # for department or administrative unit	
college or school code #	9
14 other pieces of information about unit affiliations	
social security #s	5
other information (phone, address, and % appointment)	2
universities ask for a contact person in the department	2
account # for mailing the proposal	
names of co-project directors/co-principal investigators	7
other participating faculty	1

description of proposed activity (table **2),** and sponsor identification (table **3).** For sponsor identification, all twelve universities recorded the name and other information about the direct sponsor, the agency to which a proposal is submitted. Of these, eight recorded the type of sponsoring agency to which a proposal is submitted, with one recording a quite specific breakdown of agencies: federal, foreign government, profit-making organizations, other colleges and universities, own state government, other state and local governments, trade associations and professional societies, non-government-sponsored health agencies, and other nonprofit organizations.

Table 2

Descriptions of Proposed Activity and Proposal Type Recorded by Twelve Universities

Identification Element	# of Universities
Proposed Activity	
title	12
keyword or numeric descriptors	8
abstract	6
nature of project	10
generic label "Research"	5
specific codes	5
basic research	5
applied research	5
development	4
other research	2
public service	7
other service	4
teaching/training/instruction	7
research training	1
traineeships, fellowships, etc.	3
graduate instruction	1
undergraduate instruction	
institutional support	
student aid/services	3
equipment	2
career	1
program	1
commercial testing	1
other	6
Proposal Type	
new, renewal, supplement, continuation	8
competing/noncompeting	2
proposal outcomes	7
revision status	7

Table 3
Sponsor Identification Tracked by Twelve Universities

Identification Element	# of Universities
Direct Sponsor Identification	
name	12
identification #	6
address	5
public vs. private	1
federal vs. nonfederal agencies	3
specific type of agencies (see text)	1
potential other sponsors	5
Prime Sponsor Identification	
name	1
federal vs. nonfederal	
foreign government	1
identification #	2
specific type of agency	1

Prime sponsors are agencies providing funds to other agencies or firms (direct sponsors) that disburse the funds to universities. Information about prime sponsors was tracked by only three universities, and five asked for names of other potential sponsors.

Processing *Dates*

The twelve universities requested information for three major categories of dates: university and sponsor submission dates and processing dates (table 4) and clearance dates (shown in table 5). These dates are reported here because the universities tracked them, not because they are

Table 4
Processing Dates Recorded by Twelve Universities

Identification Element	# of Universities
University and Sponsor Submission Dates	
date proposal is sent from university to sponsor	7
date proposal is entered into university database	4
proposal due date at sponsoring agency	8
postmark due date	4
Processing Dates	
dates specific to local processing activities	3
8 different dates for various approvals	1

intrinsically as important as some of the other information. Although nine of the universities recorded information about the date a proposal is due at the sponsoring agency, the tracking of other dates, as shown in table 4, is very uneven, with usually half or fewer of the universities recording any given date category.

Table 5
Clearance Information Tracked at Twelve Universities

Clearance Subject	# Requiring Notification	# Requiring Approval	# Requiring Approval Date
Human Subjects	12	3	6
protocol	1		
experimental drugs use/exemption #	1		
Laboratory Animals	11	5	2
Recombinant DNA	11	6	2
Hazardous Substances			
biological hazards	10	4	
radioactive materials	8	3	1
chemical carcinogens	7	3	
other hazardous substances (flammable chemicals, toxic substances, or noxious gases)	5	3	
Research Restrictions			
for 1, no restrictions allowed			
classified research	3		
publication restrictions	1		
proprietary information	5		
inventions	1		
pages with proprietary material	1		
demands on univ. resources after project is completed	1		
Institutional Impacts			
faculty requirements	6		
cost sharing	5	3	
university computer services	8		
cooperative agreements			
subcontracts	6	2	
consortia1 arrangements	2	2	
space			
additional on-campus space	7	1	
off-campus space	6		
prior univ. seed money	0		

Clearances and *Special* Facilities Use

All of the universities required and recorded notifications on the use of human subjects, and most required and recorded notifications for the use of laboratory animals,[5] recombinant DNA, biological hazards, and computer services and space. However, only about two-thirds required important notifications for radioisotopes, chemical carcinogens, and impacts on university computer services, and half or fewer required notification of other hazardous substances, proprietary material, classified research and unrestricted publication, and institutional impacts such as changes in faculty appointments, cost sharing, cooperative activities, or space. This information is summarized in table 5. One university's approval form contained a statement that the university would not enter into any agreement that is classified or restricts publication. In the area of proprietary information in a proposal, one wanted notification for "other than new" proposals, and one wanted a record of the exact pages of the proposal that contained proprietary material. Relatively few required prior university approval for any of these categories or recorded the dates of any of the approvals.

Another category of information which might be of importance is the presence of prior university support or "seed money" for a line of research. It would seem useful to track this as a means of assessing the efficiencies of such support, yet none of the institutions did. Perhaps they have other means to determine the results of such efforts.

Authorizations and Certifications

All of the universities required the name and signature of the project director (PD) and/or principal investigator (PI). In addition, seven universities required the PDs and PIs to sign a certification statement that the information in the proposal is correct and that they will abide by university and sponsor policies; two of these statements were quite short and five were relatively long. An example of a short certification statement is "To the best of my knowledge the above statements are correct." An example of a long certification statement is:

> The information provided on this form is correct to the best of my knowledge. The equipment budget in this application is not otherwise available for use on this project from existing department or collegiate inventories. In the event this application is awarded, I agree to abide by all applicable institutional and sponsoring agency policies and procedures and to follow commonly accepted scientific practices in recording and maintaining records of research.

Although most of this statement is representative of other long statements, its last sentence contains the **single comment about integrity of scholarship** from among the 115 elements in the entire database from the twelve universities.

A variety of additional signatures, as shown in table 6, was required by ten universities. Of these, one required authorization only from the Office of Sponsored Projects and - for nonfederal proposals - from the Development Office, and five provided detailed routing instructions to facilitate appropriate reviews.

Table 6

Authorizations and Certifications Tracked by Twelve Universities

Identification Element	# Requiring Notification	# Requiring Certification
Signatures and Certifications		
Project Director/Principal Investigator	12	2 short, 5 long
Dept./Unit head	11	4 long, 1 short
Dean	11	2 long, 1 short
Authorizations		
Fiscal/legal officer	3	
Research administration officer	7	
President, VP for Research, or Chancellor	4	
Research Board	1	
Additional administrative officers (Vice Chancellor, VP for Development for proposals to private sponsors, officer from Academic Affairs)	4	
Dean of International Studies (for international projects)	3	

Budget Information

As shown in table 7, most of the twelve universities recorded some information about budgets, though only five distinguished between the budget period and the project period, and two did not record any information about the proposed amount, start date, or end date. Although indirect cost is an important factor in funded projects, only eight universities recorded information on either the actual amount of indirect costs or the base on which indirect cost was applied.

Only five recorded detailed budget information on the PD/PI approval form or in the university database, and these included the following categories: salaries and wages, fringe benefits, consultants,

supplies, subcontracts, travel, equipment, trainee stipend/tuition, computer center services, publications, and other. Of these, one recorded both the amount requested from the sponsor and the university contribution for each category, and two recorded details on only the salaries and fringe benefits. (Probably all twelve recorded information about the final budget once an award was made, but we have no statistics on this.)

Table 7

Sponsor Budget Information and Participant Counts Tracked by Twelve Universities

Item Tracked	# of Universities
Budget Period	
proposed amount	10
start date and end date	5
Project Period	
proposed amount	5
start date and end date	7
duration of a project (months or years)	3
Indirect Cost	8
base or actual amount of indirect costs	8
actual rate used	6
ideal indirect cost for activity proposed	2
Participant Counts	
student participation	

Participant Counts

Only three universities requested information on student participation in proposed projects. This seems anomalous for research conducted in university settings, especially given the often negative impact of research on the professorial time devoted to quality teaching. One would think that universities would be interested in arguing that research is actually helping the educational environment by providing special opportunities to students.

ISSUES OF FURTHER INTEREST

In addition to the data just presented, the research reported here raised several broader issues which might provoke further discussion among research administrators: ethical issues, environmental issues, and administrative implications of some of the reported data.

Ethical Issues

Even though there has been great social and academic interest over the last few years in professional ethics, only seven of the twelve universities included certification statements about the truth of the scholarship proposed, and only one university included a statement (quoted previously) on its proposal processing forms about the integrity of scholarship and the ethical management of funds and administrative procedures.

This lack of a certification statement at most institutions may reflect a relatively passive attitude at the institutional level about ethical scholarly and administrative behavior or a relatively aggressive sense on the part of faculty and researchers that their ethical behavior is their business and not the institution's business. In either event, the lack of a certification statement is paralleled by the lack of an inquiry about potential conflict of interest in the proposed research, that is, a financial interest by a researcher (stock ownership, simultaneous consulting arrangements, management positions, etc.) in the organization for which the research is done. We note that at the moment, most universities seem not to regulate the simultaneous acceptance of consulting and research contracts from the same company, even though it is possible that in some situations a researcher may be tempted to report more favorable research results to enhance consulting attractiveness.

Another aspect of ethical behavior which appeared in this study involves the common practices of (1) requiring one project director for a jointly developed and written team project, and (2) forbidding graduate students and postdoctoral fellows from submitting proposals in their own names and instead requiring a regular faculty member to be the project director and responsible individual. Both of these policies brush against recognized ethical dilemmas involving ownership of intellectual property and appropriate allocation of authorial credit in settings involving multiple researchers. These dilemmas have been treated at the university level in discussions and reports on ethics in research (The University of Michigan, for instance, has a Committee on the Teaching of Ethics and Values and sponsors an annual University "Convention" and a series of seminars to discuss ethical issues). It has also been treated at the national level in such documents as the National Academy of Science's publication "On Being a Scientist," which overtly treats "The Allocation of Credit," "Credit and Responsibility in Collaborative Research," and "Apportioning Credit Between Junior and Senior Researchers."[6] The NAS publication concludes that the various fields have different conventions on how the names of authors should be listed but that the individuals involved in a multiple-authorship situation must "have a thorough understanding of the conventions in a particular

field to know if they are being treated fairly" [page 17) and should work out some arrangement among themselves drawing on specific discussions of the conventions and their intuitive understanding of fair play.

There is a trickier problem where an individual graduate student or postdoctoral fellow has solely conceived, developed, and written a project but is not allowed to submit the proposal in his or her own name because of university regulations requiring that regular faculty only be allowed to submit proposals. In such a case, a student must allow a faculty member to submit the student's work and be listed as the recipient of the research funding; in extreme cases, the name of the student or postdoctoral fellow may never appear on the proposal. [This practice would be plagiarism (putting one's name on someone else's work) in most other contexts, although it is standard practice in this context.] What are the consequences of this policy from the student or postdoctoral fellow's point of view? Under the reward systems in many universities today, this practice gives faculty members "credit" for research funding that should really belong to the graduate student or postdoctoral fellow. One of the authors has dealt with a number of students who felt victimized by such a system but refused to complain and would not allow anyone else to complain for fear of being blackballed by their professors; this same author has heard reports of graduate students and postdoctoral fellows at other universities in similar situations.

While we believe that most professors and institutions are quite careful about assigning intellectual property rights and authorial credit, we are aware of the pressure on researchers to produce, the extreme pressures on untenured researchers, and at least some instances of ethical corner-cutting at a number of universities on research unrelated to that studied in this project. We note that ethical corner-cutting by selected individuals is probably not diminished by the administrative policy of requiring a faculty member to submit a proposal entirely conceived, developed, and written by a graduate student or postdoctoral fellow. Finally, we note that on the basis of our observations, this administrative policy *in its application* can contribute to animosities between students and teachers, even though it may have numerous administrative benefits to the institution.

Environmental hues

Further, even though there is great social and environmental concern about the safe handling and disposal of hazardous materials, a significant number of the twelve universities did not require notifications at the proposal stage about the planned use of hazardous materials: five did not inquire about the planned use of chemical carcinogens, four about

the use of radioisotopes, and seven about the use of other hazardous substances. In addition, one university did not even ask for notification about the use of recombinant DNA, and two did not ask about the use of biological hazards. We suspect that these practices would make it harder for a university to monitor its safe use and disposal of these substances. Even more striking is the lack of prior approvals of the use of human subjects, recombinant DNA, chemical carcinogens, biological hazards, radioactive substances, and other hazards. We note that some of this information may be sought after an award is made, but it appears that at least some universities do not require it at all.

Administrative *Implications*

In addition to the comments just made, the data raise some other questions for consideration. First, all but two of the universities are large, public, research universities, and the other two are of moderate size with a high volume of research. In spite of these similarities, some universities collect much more data than do others, and some collect much more administrative data. There is now a trend toward streamlining the research administration process as exemplified by the Federal Demonstration Project to relieve faculty and administrators of some onerous bureaucratic requirements. Might it now be appropriate for the universities to' reduce their internal form-filling load on project directors and to collect less administrative data?

On the other hand, given changing political, social, and environmental concerns, perhaps those universities which have collected primarily administrative data need to begin collecting data relative to those concerns. As a stimulus for discussion, we have included as figure 1 an "ideal" preaward tracking and approval form which includes the major administrative categories of information on most forms in addition to items reflecting the political, ethical, and environmental concerns noted above.

Finally, we would like to note that the study reported here involved only twelve universities. We would like to be able to do a more comprehensive analysis and to make comparisons across types of institutions. We thus request research administrators from any institution to send us copies of their proposal processing forms, database entry forms, and lists of elements in their proposal/award database. We request that these be sent to Robert R. Beattie, Division of Research Development and Administration, 475 E. Jefferson Street, ISR 3 Room 1300, University of Michigan, Ann Arbor, Michigan 48109-1248.

Figure 1

"Ideal" Preaward Tracking and Approval Form

Proposal No. _____
(Assigned by Sponsored Projects Office)

Form Prepared by _____

Telephone _____

1. Submitted to: a. _____
Direct Sponsor

b. _____
Prime Sponsor (if any)

2. Project Title: _____

3. Project Descriptors (list three key words or short phrases not contained in the Project Title)

_____

4. Staff

a. _____
Project Director Social Security Number Department/ Unit Code Unit Telephone Sex/Race

b. _____
Co-Investigator Social Security Number Department/ Unit Code Unit T&phone Sex/Race

c. _____
Co-Investigator Social Security Number Department/ Unit Code Unit Telephone Sex/Race

5. Proposed Project Period: _____
Start Date End Date

6. Proposed Project Budget: _____

	Cost Sharing	Sponsor	Total
Total Direct Costs			
Indirect Costs			
TOTAL			

Indirect Costs Rate _____ %

7. Details of Cost Sharing

Line Item	Amount	Account Number	Unit Code	Approved by

8. Does the proposed activity involve: (A "yes" or "no" response is required for each item in this section)

a. Use of human subjects ____ No ____ Yes
If yes, date of committee approval _____

b. Use of vertebrate animals _____ No ____ Yes
If yes, date of committee approval _____

c. Carcinogens - No - Yes
If yes, specify _____

d. Recombinant DNA - No ___ Yes
If yes, specify _____

e. Biological hazards - No __ Yes
If yes, specify _____

f. Proprietary materials - No __ Yes
If yes, attach details

g. Classified research - No __ Yes
If yes, attach details and approvals

h. Other restrictions on openness of research - No __ Yes
If yes, attach details and approvals

i. Potential conflict of interest - No - Yes
If yes, attach details and approvals

j. Work off University property - No __ Yes
If yes, identify location of research _____

k. Study of another country - No __ Yes
If yes, name of country _____

1. Creating new intellectual property - No __ Yes
If yes, attach details and approvals

m. Major impact on computing facilities - No __ Yes
If yes, attach details and approvals

9. Number of Participating Students: Fellow __ Graduate __ Undergraduate __

What capacity (principal investigator, co-investigator, paid assistant, volunteer assistant, subject)? _____

10. University Funding

Have University funds been used as seed money or pilot project support for this proposal ? - No __ Yes

If yes, provide: Source _____ Amount _____

11. University Space to Be Used

Room	Building	Building Code	Approved by Dean/Director

If insufficient space is available, indicate square feet required _____

Source of Space _____ Approval _____

12. Foreign Nationals to Be Involved (Provide name, if possible, and capacity)

_____

13. Proposal Type

a. Instructional - Research ~ Other Sponsored Activity __

b. Response to an RFP - Unsolicited Submission -

c. New - Competing Renewal - Noncompeting Renewal ~

14. Due Date

Date due at sponsor _____ Postmark _____ Arrival _____

Notes

I certify that the proposed work is consistent with the University unit objectives and that all faculty involved in the proposal have agreed to participate. I accept the obligations and commitments described, and I agree to perform the work in accordance with University and sponsor policies and to follow commonly accepted scientific practices in conducting, recording, and interpreting research.

_____
(Project Director)

APPROVED BY

_____ _____
(Department or Unit Head) (Sponsored Projects Office)

_____ _____
(School/College Dean) (University)

CONCLUSION

This study has compared the tracking of information through the administrative offices of twelve research universities and has demonstrated that some universities collect a large amount of data while others collect much less. Although not all predictable information was tracked, most of what was tracked was quite predictable: all twelve universities required the name and signature of the project director and/or principal investigator(s) and information related to proposal identification, and eleven required additional signatures from responsible university officials. All twelve required notification of the use of human subjects and most required other notifications, but the specific notifications varied markedly.

The tracking of other information varied markedly among the universities, including information that may also seem to be predictable or of national interest. For instance, a number of the universities did not inquire about information related to the ethical behavior of its researchers from either a scholarly or institutional point of view, affirmative action information, environmental issues, institutional impacts, educational impacts, restrictions on research projects, and effects of funding mechanisms on research agendas. In addition, none or few of the universities apparently tracked the impact of a project on the university's space, computer facilities, or staffing; the number of students working on a project; the presence of prior university support or "seed money" for a line of research (as a means of assessing the value of such internal support); or the affirmative action status (sex/race) of the investigators.

Finally, in looking at what was and was not tracked at the universities, this study suggests that research administrators might want to reconsider some of the ethical, environmental, and administrative implications of some of their policies and to consider the "ideal" preaward tracking and approval form presented in figure 1.

REFERENCES

l This material is based upon work supported by the National Science Foundation under NSF Cooperative Agreement No. ASC-8617699. We would like to acknowledge the contributions of William Brinkerhoff, who entered the original version of the data and assisted in developing the taxonomy reflected in this paper. Any opinions, findings, and conclusions or recommendations expressed here are those of the authors and do not necessarily reflect the views of the National Science Foundation.

[2] The University of Michigan system is based on the Diamond system developed by Bolt, Beranek, and Newman and the TeX system developed by Arbortext. These systems are described in the following: Robert H. Thomas, Harry C. Forsdick, Terrence R. Crowley, Richard W. Schaaf, Raymond Tomlinson, Virginia M. Travers, and George B. Robertson, "Diamond: A Multimedia Message System Built on a Distributed Architecture," Computer (December 1985): 65-78. Arbortext, Macro Package User's *Guide:* Expres (Ann Arbor, MI: Arbortext, Inc., 1987). The Carnegie Mellon system is based on Andrew developed with funding from IBM and is described in James Morris, Mahadev Satyanarayan, Michael Conner, John H. Howard, David S. H. Rosenthal, and F. Donald Smith, "Andrew: A Distributed Personal

Computing Environment," *Communications* of the ACM (March 1986). The entire EXPRES system is described in Leslie A. Olsen, "Computer-Based Writing and Communication: Some Implications for Technical Communication Activities," Journal of Technical Writing and Communication 19:2 (June 1989): 97-118.

[3] Leslie A. Olsen, Robert R. Beattie, and William Brinkerhoff, *Processing* Sponsored Project Proposals **at** Twelve Universities, report to the National Science Foundation, March 6, 1988.

4 Each university has a form for proposal processing: Proposal Transmittal Check Sheet; Proposal/Award Processing Sheet; Extramural Support Transmittal Form; Statement of Commitments and Endorsement of a Proposal for a Sponsored Project; Application to Seek Off-Campus Funds; Route Sheet for Research and Sponsored Program Support; Transmittal Sheet for Request for Contract, Grant, or Gift Support; Approval of Application for Grant or Contract; Application for External Research or Training Support; Funds Application Summary; Sponsored Project Approval Form; Proposal Transmittal Form.

[5] Only eleven of the twelve universities recorded notification of the use of laboratory animals when the data were collected in 1987. All twelve may now collect this data given the recent changes in the National Institutes of Health's requirements on approval of animal use.

[6] National Academy of Sciences: Committee on the Conduct of Science, *On* Being *a Scientist* (Washington, D.C.: National Academy Press, 1989), 16-18.

Reports /Observations

The University Research Enterprise

John S. Wodarski

Universities are operating in new complex environments in terms of knowledge and technological explosions. Within the last two decades, the U.S. industrial economy has changed to an economy based on information technology. Universities must be equipped to deal with the issues that force change on our society, i.e., the competition of world markets, responses to new markets, management of environmental concerns, the need to increase industrial productivity, and technological transfer activities. In addition, exploding technologies in the hard sciences and computer fields contribute significantly to the environment in which universities find themselves. At the same time, federal, state, and industrial support for research at various Ievels is ambiguous. In fact, data indicate that research support in the United States has reached a plateau as compared with support in countries such as Japan and West Germany.

Universities desirous of maintaining or increasing their research activities will have to change with the times. Many universities currently are, or are striving to become, major research institutions. The scholar who indicates that all he or she wants to do is to teach, read, and write will be in the minority in the future. Research is expected in all fields of endeavor on the university campus. This research entails different activities for various faculty, however. Most universities will emphasize research on the complex issues that face society, such as the development of new sources of energy, new industrial technologies, health care for the elderly, and development of adequate food supplies. The body of knowledge in each of these areas is constantly changing and growing, and the knowledge needed to solve these problems is dependent upon interdisciplinary studies.

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The five recommendations that follow would facilitate university research.

Universities must continually demonstrate their efficaq *in* addressing *issues of* public concern.

In the manufacturing economy of the twentieth century, the nation's industries have concentrated on production and its universities have focused on instruction. For many years, this approach has been eminently successful in building a powerful economy and a high quality of life. But there is strong evidence that, as the world economy has shifted away from a materials- and labor-intensive foundation toward one relying on technology for real growth, the universities need to refocus their approach. Starting now, universities must concentrate on the direct transfer of university research to industrial processes and products.

Technology transfer programs are a vital part of the new economic equation, but each program's long-term efficacy is limited. The fact is that such ventures are merchandising a scarce resource: knowledge. When a university's expertise in a particular area is exhausted, or becomes obsolete, there will be nothing left to transfer.

All technology is built on a scientific foundation. The base is as solid as nature, but those who study natural phenomena know that nature frequently offers many alternatives. This is not a new observation, and industry never has failed to appreciate the importance of fundamental scientific inquiry. Industry, nevertheless, generally has not found it cost-effective to pursue basic research itself. Fundamental investigation has been largely the province of universities in the United States (in other countries, national laboratories play an important role). For the most part, industry has taken the position of observer, waiting for research to move from basic investigation to inquiry to possible applications before moving to acquire it.

Critics of American industry, particularly of the traditional manufacturing corporations that comprise the heart of the Midwest's economy, have argued that the delays in translating new knowledge from laboratory bench to shop floor have been too long, and that this failure has been central to the loss of competitiveness which plagues the region.

Whatever the source of past failures, the attitude of industry is now quite different. Corporations of all sizes are hungry for new technology and are becoming more adept every day at integrating it into new products and processes. Industry is now seeking to recognize new approaches earlier in the stream of knowledge; however, its sponsorship of basic research, whether in-house or at universities, is still extremely

limited. Only the largest multinational businesses can afford to invest resources in investigations of mostly unknown benefit. The burden thus remains with the universities.

Universities must *provide the major* leadership role *in educating the* public *about* the cost *of* high technological innovations.

Not only is societal demand for new knowledge vastly greater than in the past, but the cost of research is accelerating in proportion to its growing complexity. In our rapidly changing technological environment, much scientific equipment has a useful life of no more than a few years. Facilities, which once were adequate for instruction and a limited level of laboratory research, cannot meet today's demand for a much higher level of activity nor the exigencies of exotic new materials and sophisticated new processes. Competition for the best faculty and graduate students (and only the best will do when the goal is to advance the state of the art) is far greater than the public imagines. The personnel problem for the universities is cut by both blades of the scissors: on one side the supply of high school graduates is diminishing, as is the propensity of these students to pursue careers in science and technology; on the other side, demand is growing as industry begins to compete much more aggressively for the same talent pool.

Universities must play a major role in development, enhancement, and maintenance of the United *States as the* leading center **of** high technology.

The research function supports programs which attract business and industry to a particular region or state, or which keep major industries in the state, Research programs provide a pool of trained specialists which is necessary if the industrial community is to compete successfully at the international level. In addition, new products and processes are developed which have the potential to create new employment opportunities. Research programs provide a pool of consulting talent which provides technological transfer to area industrial concerns.

Research universities located in major industrial communities must have an attractive research program that stimulates industrial development, aids in the transfer of state-of-the-art technologies, and facilitates development of commercial prototypes.

The development of short-term (two-year) and long-term (five-year) goals *is essential.*

Both short- and long-term goals are necessary if universities are to develop competitive products for world markets. Because universities

do not have unlimited research resources, strategic planning is essential. These comprehensive plans will involve difficult decisions; thus, universities must find appropriate forums to facilitate such decision-making processes.

The continued development of research capabilities in the United Stares is essential to ensure the standards of living for this generation and future generations.

The continued development of the United States as a center of high-tech industries will facilitate international economic vitality. Efforts to enable the nation to become a center of high-tech research will support our current standard of living. To take the lead in high-tech technology, we must continue to develop research environments that are conducive to increased productivity. The number of bureaucratic structures slowing down or hampering the research process must be reduced and industrial/university relationships must be facilitated. Universities are essential to producing these environments, as well as to developing a capable work force for high-tech industries.

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