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## STRATEGIC OPTIONS TO ENHANCE THE RESEARCH COMPETITIVENESS OF EPSCoR UNIVERSITIES

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### INTRODUCTION

This paper outlines options for enhancing the competitiveness of EPSCoR universities in securing external research support. Competitiveness occupies the center of the paper because the larger part of federal funds and substantial portions of the funds provided by industry and foundations for academic research are allocated primarily according to competitive review processes and criteria. A university's or state's share of federal or total academic research funding thus flows primarily from how well it fares in this competitive environment.

The dominant characteristics of the U.S. system of awarding federal funds to support academic research are open competition to all applicants, peer review of the quality of proposals, and emphasis on scientific merit as a proposal selection criterion. This system is widely held to have contributed to the U.S.'s preeminence in many fields of scientific research and to its distinctive integration of research and graduate student education and, increasingly, of undergraduate students (Clark, 1995). However, the system also has re-

sulted in the concentration of academic research and development (R&D) funding, whether measured by the distribution of federal awards or by total academic R&D expenditures. In 1997, for example, the top 10 university performers accounted for 19.2 percent of federally funded academic R&D expenditures, while the top 50 universities performed 51.0 percent and the top 100 performed 79.1 percent of this total. By state, the top 5 states accounted for 41.5 percent and the top 10 states accounted for 59.7 percent of federally funded academic R&D. In contrast, the aggregate share of the states with the smallest shares was 2 percent, while that of the lowest 20 states was 6 percent. EPSCoR universities fall mainly into this last group.

These patterns of concentration are longstanding. They have deep historic roots in the concentrated geographic location of the private universities that made the earliest and most intensive commitment to research, to differences in state populations and economic bases, and to state policies regarding support of higher education (Goldin and Katz, 1999). Moreover, patterns of concentration by institution or state have become somewhat less marked over the 1980–1997 period (Feller, 1999). Still, for many institutions and states, and certainly those within the lower portions of the distribution of federal academic research funds, increased dispersion (or decreased concentration) is a desired objective.

## CONTEXTUAL FACTORS

Although this paper focuses on institution- and state-specific strategies to increase research competitiveness, its assessment of the likely effectiveness of these strategies is conditioned by an assessment of the forces affecting the larger external environment within which all universities compete for research funds.

Among the major national factors seen as likely to affect the efficacy of specific strategies are the following:

- Long-term trends in the external financing of academic research remain uncertain despite substantial increases in FY1999 appropriations for NIH and NSF and continuing congressional expressions of intent to substantially

increase federal support for basic research. Existing caps on federal expenditures in the 1997 budget agreement and building pressures for some combination of tax reductions and shoring up of the social security system may limit the revenue available to fund discretionary domestic expenditures, which include non-defense R&D, in the future.

- Industrial support of academic research may be leveling off (as a percentage of total academic R&D). More pronounced is firms' tendency to concentrate their R&D funding in a smaller number of institutions.
- The portion of academic R&D financed from internal (institutional) sources has risen steadily since 1976, amounting to 18 percent in 1996. The sustainability—financially or politically—of this trend, especially for public universities, is problematic given current pressures and priorities for public universities to enrich the undergraduate experience.
- Beyond its size, the future structure of the academic research enterprise remains much in doubt and debated. Nationally, university presidents and academic leaders hold considerably divergent perspectives about future patterns of concentration/dispersion of the American research university system. They also differ about the desirability of national initiatives to substantially increase the number of research-oriented universities. The claims of EPSCoR institutions for any significantly larger share of total federal funding likely will be seen (and opposed) nationally as special pleading by non-EPSCoR university leaders unless sanctioned by competitive, merit-based procedures.
- The number of universities looking to maintain or enhance their research-competitiveness, national standing, or R&D funding share is increasing. For existing research institutions and an increasing number of aspiring universities, excellence means becoming a (more) research-intensive institution. Statements by EPSCoR universities

of aspirations to “move up” in rankings as R&D performers or in state shares must take into account the same statements being made by aspiring non-EPSCoR universities. The strategies open to them most often differ more in degree than in kind for EPSCoR institutions. No established leader (university or state) is indifferent to competitive threats to its position; many have launched major new initiatives to buttress or enhance their positions. EPSCoR and non-EPSCoR institutions may each be seen as engaged in a continuing effort to sustain or achieve institutional excellence.

- Strategic thinking and language have become a standard part of university vocabularies, planning, and actions for well over a decade (Keller, 1983). Strategic planning at most universities today is primarily a matter of implementation and revision, not formulation. Few, if any, of the strategies presented below are thus likely to be new. This should not be surprising. For the most part, the strategies cited are those presented by university leaders, and they represent existing “best practice” or “conventional wisdom.” Few strategies available to EPSCoR institutions are not available to non-EPSCoR institutions. In an arena of intense competition, the challenge for EPSCoR universities is not simply to achieve the average rate of increase in federal funding of academic R&D, but to accelerate their steps towards becoming nationally competitive.

Structural differences do exist between the EPSCoR and non-EPSCoR universities. EPSCoR universities, on average, have a relatively greater dependence on funding from state governments and USDA than do non-EPSCoR universities, and the latter have a relatively higher percentage of their funding from NIH. Federal funding of academic research has grown most rapidly in biomedical research, funded primarily by NIH. EPSCoR states are disproportionately represented among the states with small medical schools or without medical schools. EPSCoR universities also are typically public rather

than private universities. Private universities in general have more latitude in allocating internal funds to underwrite modernization and expansion of research facilities than do public universities. Public universities by way of contrast must increasingly demonstrate to elected officials that state appropriations are directed primarily at instructional rather than research activities.

In addition to these characteristics of the external national environment, two other considerations affect the formulation of strategies to enhance the research competitiveness of EPSCoR institutions.

1. Eligibility to participate in the EPSCoR program is based on state- rather than institution-level measures of research performance. In fact, considerable differences—quantitative as well as qualitative—exist in research capacities and performance among EPSCoR universities and colleges. (For example, using the Carnegie Classification system, the 56 universities that participated in the EPSCoR program in 1995 ranged from Research I to Doctoral I institutions.) EPSCoR institutions differ significantly according to several structural variables that affect the research performance and competitiveness of universities. These include institutional size and budgets, state-level variables such as level of appropriations, structure and governance of higher education systems, industrial base, rates of growth of population and economic activity, composition of sources of external research support, and internal histories and cultures.

2. EPSCoR universities vary considerably in measures of total and federal R&D expenditures. Five EPSCoR universities (University of Alabama-Birmingham [28], Louisiana State University [74], University of Kentucky [76], University of Kansas [93], and University of Oklahoma [94]) ranked among the top 100 institutions in total federally funded expenditures in 1997, with some of these institutions having achieved significant recent advances in total R&D awards and relative standing. Other EPSCoR institutions rank relatively low in total or federal R&D expenditures and have exhibited little increase (relative to national levels) in these expenditures during the past 15 years.

The obvious conclusion from a listing of these differences is that the strategies for different institutions likely will differ. Strategic options for EPSCoR institutions thus must take the form of a

generic menu from which institutions and states select the most appropriate main choices, which must then be further seasoned to meet site-specific settings.

## STRATEGIC OPTIONS

University strategic planning is often predicated on what rivals or exemplars have done, and given the recent diffusion of benchmarking practices, on what they are doing. While engaging in this process, universities can lose sight of the interactions between their behavior and that of their rivals. If benchmarking, for example, on electronic research administration leads multiple universities to adopt the same innovative practices, the result may be more efficient internal procedures but not necessarily a lessening of the competitive scramble for external research funds. Strategic planning, in this example, simply leads to new requirements as to what constitutes a competitive minimum. To cite another current example, if multiple institutions seek to develop “niches” of excellence in biotechnology or information science, the short-term result can be a sharp increase in the cost of the scarce factors of production—namely, faculty salaries and start-up packages—needed to start these programs, but not necessarily a great leap forward for any single institution. Institutions that fail to make investments in these fields can be expected to be out of the running for any new stream of research funds flowing into the area, but institutions that make these investments cannot be assured that their expenditures (or “investments”) will insure competitive successes. There may simply be too many institutions attempting the same strategy.

The account of strategies is predicated on consensus among university officials and faculty about the factors that shape research competitiveness. These factors include a research-productive faculty who are recruited in national markets and whose performance is vetted by national norms for research outcome; competitive salary levels and teaching loads; high-quality graduate students; state-of-the-art equipment and research facilities; flexible and supportive organizational arrangements and institutional policies (on purchases, per-

sonnel, and travel); and a supportive central administration which makes national standards of research performance a key institutional objective (Feller, 1996; Teich and Gramp, 1996).

Strategic options available to EPSCoR universities to enhance their competitiveness for external research funds are presented below. In each case the strategy is briefly described, followed by an assessment of its strengths and weaknesses. For purposes of presentation, the strategies are listed as discrete choices, or pure strategies. In fact, several of the strategies constitute specific refinements of other, more global strategies. More importantly, many (but not all) of the strategies may be combined into a “mixed” strategy. The mixed strategy approach more closely approximates the span and heterogeneity of research and graduate degree programs found on most campuses as well as the diversity of external funding opportunities and stakeholder interests in the composition and character of an institution’s activities. A mixed strategy also permits an institution to select the strategy that is most effective to a particular discipline, college, or constituency.

The risk of the mixed as compared to the pure strategy is that the former may dilute the resources or level of commitment needed to effectively implement a pure strategy. A mixed strategy also may be more difficult to describe to faculty, students, or relevant stakeholders, such as state officials, industrial leaders, and parents of students. Difficulties in communicating the strategy may cause the institution to emit mixed signals as to its purposes or priorities, leading to opposition or inefficiencies as the strategy is implemented.

Ten strategies are considered: Increase the Number, Size, and Quality of Research Proposals; Niche Markets; Interdisciplinarity; Catch a New Wave; Collaboration; Emphasis on Industrial and Applied Research; Build a Medical School; Bootstrap; Political Leverage; and Strategic Redefinition of Objectives.

### **Increase the Number, Size, and Quality of Research Proposals**

Abstracting from formula-based funding (say, for state Agricultural Experiment Stations under Hatch funding) or specific congressional earmarks, the amount of externally funded research sup-

port received by a university is primarily the product of the number of proposals submitted by its faculty, the percentage of these proposals that are funded, and the average size of the awards. Enhanced institutional research competitiveness entails improving performance with respect to each and all of these three variables.

a) Increasing the number of proposals submitted relates to the institutional commitments of universities and their faculty to research and to the necessity, criticality, or convenience provided by external research support. A strategy to increase the number of faculty writing proposals is likely redundant in universities, colleges, or departments already committed to national standards of research or where external support is necessary for the conduct of research. Faculty likely are fully employed in this activity, and so strategy moves on to focus on other parts of the university or to b) and c) below.

The strategy of increasing the number of research proposals likely has more relevance in universities and units that have made new or more intensive commitments to research performance. Some faculty, particularly in the science and engineering disciplines, are socialized to seek external research support and thus to write proposals early in their graduate or post-graduate training; other faculty are not (or are less so). What the first set needs or is most likely to need, as indicated by the Teich-Gramp findings, is infrastructure support—ranging from secretarial and budget assistance to service-oriented sponsored research offices.

Proposal writing also often means rewriting, whether it be revisions or new proposals. How a unit treats those who have tried but failed can be an important element in determining future endeavors.

Evident in these observations is the recognition that proposal writing is neither a spontaneous process nor a costless endeavor. Academic administrations exhorting faculty to write more proposals may squeeze some more work from faculty—the WTBH strategy, as it has been called—but are unlikely to find this a viable (or productive) long-term strategy.

b) The goal of “bigger” proposals, as one EPSCoR project director has described it, is to move the size of the budget over by first one and then two zeros—from \$50,000 to \$500,000 to \$5 mil-

lion. Strategic planning to increase the average size of proposals (and awards) entails setting new sights or standards about the complexity, scale, or intellectual stretch of individual or institutional research aspirations.

Underlying this strategy is the premise that the scale of research a faculty member undertakes is not fixed but rather can be shaped by organizational cultures and resources. Given modest institutional norms, faculty may be satisfied with reasonably assured success in securing external funds involving modest amounts to address modestly interesting research problems. They may eschew higher-risk endeavors that entail seeking major awards to address more fundamental, complex, or significant research questions because of doubts about whether (i) they will be given serious attention in peer review processes; (ii) they can satisfactorily perform the research; and (iii) their institution will provide the resources required to complement those obtained from external sources.

To elevate faculty aspirations, institutional strategy needs to be directed at (b) and (c). Its most significant potential role may rest in encouraging risk-taking behavior directed at major research undertakings. A specific element of this strategy includes recruiting faculty with demonstrated experience in leading major research groups. Such individuals may or may not be “stars” in the conventional sense with which this term is used in academic circles. Rather, it focuses on individuals who have a penchant for collaborative work often organized around program or center-like thrusts.

c) The strategy of improving the quality of proposals is intended to increase the likelihood that proposals will be funded. Phrased differently, it is intended to prevent what could evolve into a process of proposal generation but limited success into success ratios that approximate those achieved by faculty at nationally ranked institutions.

Improvements in the quality of proposals require first that faculty and institutions understand what the quality standards are for success in those agencies, particularly NIH and NSF, where scientific merit strongly affects peer-review recommendations. Strategic action here is directed at developing processes that enable faculty to

course through an equivalent internal review process prior to formal submission of a proposal to an agency. In effect, this strategy extends and systemizes to a wider number of proposals; elements of a strategy have already been incorporated into the activities of EPSCoR universities, particularly as they have prepared their proposals to NSF and other federal agencies.

The strategy, to be effective, requires that (a) the reviews truly approximate those likely to be administered by panels; (b) faculty understand that criticism is an essential part of enhanced competitiveness; and (c) faculty accept the hard work associated with revision.

Competitiveness, in short, is hard on the ego. It also can be a time-demanding undertaking that requires institutional flexibility in released time from other activities. Various methods exist to implement this strategy, including reviews by a university's own faculty or by external experts brought in as a pre-screening panel.

This strategy of more, bigger, and better proposals implies that a university has essentially all the critical elements—resources, leadership commitments, policies, and organizational forms—needed to be a nationally competitive research university. It also means that the university has a sufficiently large number of nationally competitive faculty distributed over several disciplines and/or academic units to support an already sizeable research and Ph.D. degree program.

The downside to this strategy is its mirror image: overreaching, or attempting to move too rapidly or on too many fronts without the necessary resources or broad-scale institutional commitments (by deans, department heads, and even faculty). Both internal and external constituencies may continue to champion other institutional missions—undergraduate education, outreach, applied research relevant to local industries—that drain both resources and leadership from the inspiring but difficult-to-achieve objectives of enhanced national research standing.

### **Niche Markets**

The concept of niche markets pervades current strategic thinking in American higher education. These precepts of selectivity, strategic areas of emphasis, and concentration have been voiced by

presidents of America's major private research universities—Yale, Chicago, Rochester—and are widespread across public research universities. The strategy is a logical corollary to the repeated refrain that no university has the resources or existing expertise to be all things to all people, but must focus its resources instead on a small, select number of research areas.

A strategy of niche markets would appear to have even greater relevance and attraction for EPSCoR institutions, which, on average, operate with smaller resource bases and lower (NRC) ranked programs than those of the universities with which they seek to compete. A strategy of niche markets indeed is implicit in NSF's EPSCoR program's features: promotion of research clusters; intra-institutional and intra-state competitive processes to identify the research thrusts to be included in a state's proposal to NSF; and de facto institutional provision of funds to match NSF and other federal agency EPSCoR awards.

A niche strategy also plays to existing institutional strengths and unique research opportunities. A combination of geographic and climatic settings, proximity to federal laboratories or major industrial firms, or serendipitous concentrations of outstanding faculty in selected research fields may provide an institution with a springboard to national research competitiveness. Careful attention to the linkages between these fields and complementary fields of knowledge can be used to leverage external support and enhanced quality in others. The rise to national standing of the University of Arizona—initially in meteorology, then in astronomy, and then in the related field of optics—fits this model (Geiger, 1993).

Despite its widespread appeal, there are limitations and drawbacks to the niche strategy. It is generally presented as meaning choices among research areas and graduate degree programs, but in fact the costs of selectivity and concentration may be higher than suggested. For example, Geiger describes the niche approach—or “building steeples of excellence,” following the oft-cited example of Frederick Terman's strategy at Stanford—as “implying a kind of institutional triage in which many units will be relegated to teaching or service roles” (1996, p. 125). More than just selected graduate degree

programs may be sacrificed in the process. Leslie, for example, presents the implied costs of the steeples of excellence strategy as follows:

Do not waste time with the undergraduate programs, Terman advised, for they never pay big dividends no matter what kind of resources are devoted to them. ... (P)ut the effort into the graduate programs, where national reputations are forged. Do not deviate from the guiding principles of the 'mainstream' theory and the 'steeple' concept. There was no point in creating excellent programs in fields no one cares about (Leslie, 1973, p. 45).

A niche strategy that involves such costs on the undergraduate program may be politically untenable in public universities that draw substantial portions of their revenues from parents and taxpayers. At a state level, the strategy implies selectivity and concentration of resources in those state universities that have stronger research programs, a policy that can run counter to institutional and state government interests in pursuing a broad distribution of resources among institutions (Lambright, 1996).

In addition, successful implementation of the niche strategy implies identifying a niche that is sufficiently wide and deep to have a meaningful impact on an institution's research reputation and level of external funding, but is sufficiently narrow that other established research universities or competitors from other aspiring institutions do not seek to fill the same area. This task is not easy. A niche, by definition, is a narrow area: if too many aspirants seek to fill the niche, the immediate result is that some will not fit in or will be squeezed out. In practice, the prevailing penchant for niche strategies in university strategic planning is more effective in defining the areas that an institution will cut back on or not go into than it is in guaranteeing that the investments in research areas to be strengthened or entered will prove worthwhile.

### **Interdisciplinarity**

A generally high correlation exists among size (as defined by number of faculty, enrolled students, and number of graduates) and measures of the scholarly quality of program faculty (National Research Council, 1995, p. 34). Interdisciplinarity seeks to overcome

the limitations of institutional size by configurations of faculty about research thrusts rather than academic cost centers—that is, departments. Rather than attempt to achieve research competitiveness along traditional disciplinary lines, the strategy seeks to build competitiveness at the boundaries of disciplines through supporting interdisciplinary efforts. These efforts include established techniques such as championing the creation of interdisciplinary research institutes and centers on campus, and, perhaps more importantly, organizing fields of study and hiring faculty along interdisciplinary lines.

Interdisciplinarity has been a winning strategy for a small number of universities, primarily in engineering-oriented institutions such as Carnegie Mellon. This strategy gains support from the findings from the Stahler and Tasch study (1992) that fast-growing research universities conducted more of their research in institutes than did slower growing universities. It also draws strength from specific programmatic initiatives and general statements from NIH and NSF that major funding will be directed at cross-disciplinary approaches to scientific and engineering research.

The downside to this strategy is the challenges it presents to the traditional disciplinary and departmental structure of most universities, the tendency of faculties and university administrators to employ disciplinary-based reference groups in promotion and tenure decisions, and—unintentionally perhaps—the “conservative” consequences of benchmarking techniques, which favor established academic fields. These challenges are not easily overcome. Indeed, only a few technology-oriented universities may be said to have successfully used this strategy to achieve national research competitiveness. For most institutions, adoption of this strategy would require a fundamental rethinking and restructuring of the institution.

### **Catch a New Wave**

The strategy here is to identify and implement research programs that address the most intellectually exciting scientific and technological questions of the next major wave of federal and other external sources of funding. A variant of that strategy is to reinforce existing niches of research expertise in the hope that they become

the hot, mainstream area of scientific research in the near future. In either case, the goal is to so concentrate institutional resources as to be at the forefront of the new wave rather than a niche or distant performer of pre-existing mainstream research.

Seeking to identify a new wave—a paradigm-shifting line of research—is a high-risk, high-return strategy. The vaunted mainstream of scientific research often is visible (and navigable) only after revolutionary, breakthrough advances have been made (Cohen, 1985). Prior to that time, however, the channels by which new scientific knowledge is to be communicated are imperfectly perceived and frequently disputed (Horgan, 1996). (Howard Temin’s work in the 1960s on viruses as a cause of cancer was “widely held to be scientifically bizarre and wrongheaded;” in 1975, Temin shared a Nobel Prize with David Baltimore and Renato Dulbecco for their research [Kelves, 1995].) Although each decade typically yields a list of new wave topics (information technology and neurosciences, for example, being cited as the successor to recombinant DNA research as a “hot” field of research), considerable uncertainty exists about which lines of research will prove productive and thus lead to sustained federal government and other external research support.

EPSCoR institutions confront not only these “scientific risks” but also what may be termed “economic” or “retention risks”—namely, that if they recruit and support researchers capable of generating breakthrough findings, these researchers, when successful, will be bid away by established research universities.

### **Collaboration**

Collaboration involves combining the expertise of several institutions to overcome the shortcomings of a lack of critical mass in faculty and equipment. It offers opportunities for faculty and institutions to participate in important and large-scale research undertakings that they could not successfully pursue themselves.

Collaboration may take several forms. It can involve employing the unique research facilities or settings of an EPSCoR university, as in Montana and Nevada, to attract the collaboration of faculty at more research-intensive universities. It can entail appoint-

ments between an EPSCoR university and a non-university research laboratory, an arrangement that serves to apportion the salary costs of a faculty member while providing opportunities for him or her to work at research organizations with state-of-the art facilities lacking in the EPSCoR university. It may involve accepting supporting roles in terms of specification of principal investigator(s) or lead institutions to more established researchers. Whether as a transitional or permanent arrangement, the net outcome is higher productivity and reputation for a university and its faculty than would otherwise be the case. In some states, collaboration means bringing together two (or more) essentially autonomous units of a university—especially a main campus and a medical center—to form a larger research team.

Criteria contained within select federal research awards—that institutions demonstrate commitment to broadened participation of historically underrepresented groups in research, teaching, and related programmatic objectives—also offer singular opportunities for historically black universities and colleges and other minority institutions in EPSCoR states (as well as in non-EPSCoR states) to leapfrog existing institutional constraints on research competitiveness by collaborative arrangements that enable them to participate in major research projects.

Collaboration, however, is a strategy that takes considerable time and effort to implement. It requires building information and communication linkages where none may have existed before. It requires substituting negotiation, trust, and a positive sum perspective for what at times may have been contentious, zero-sum relationships within universities in a state.

### **Emphasis on Industrial and Applied Research**

Universities in EPSCoR states, on average, receive a higher percentage of their funding in the fields of agriculture and engineering than do the more research-intensive universities in non-EPSCoR states. This pattern follows from the predominant role of public universities in EPSCoR states, many of which, like public universities in non-EPSCoR states, had their research programs arise about applied research topics of relevance to the state's industries (Feller, forthcoming).

Within this historical context, efforts at enhancing research competitiveness for several EPSCoR universities have been directed at strengthening basic science and engineering fields. This strategy has sought to capitalize on the increased role of NIH as a source of academic research funds, to be more competitive for peer-reviewed individual investigator and non-sheltered program competitions from NSF, and to compete for the more basic research programs of mission agencies such as DoD and NASA.

An alternative strategy is to concentrate on the institution's historical strengths in applied research, focusing on industrial sponsors, state agencies, and the applied research programs of mission agencies. This concentration of emphasis includes not only research competencies, as reflected in faculty and research facilities, but formulation of institutional policies on intellectual property rights, technical assistance, and curricular content to enhance the value of the institution to the "customer." The strategy also seeks to capitalize on linkages between key state economic sectors and state government, using improved relationships with the state's industries as a means of obtaining supplemental state support.

The downsides to this strategy include the small size of the industrial sector in several EPSCoR states, which limits the revenue potential from focusing on intra-state sponsors; and the loss in intellectual and economic synergies that can come from too sharp a separation of basic and applied research within an institution. The strategy also runs counter to industry's interest in establishing longer-term relationships with a small number of institutions that are capable of performing the fundamental research that underlies the firm's core technologies. The strategy also may involve a move away from the largest (and fastest growing) source of federal funds for academic research—NIH.

### **Build a Medical School**

Recent experiences of research universities and projected trends in the composition of federal academic research point to the possibilities of building institutional research competitiveness about an academic medical center. During the 1980s, academic medical

institutions—either as free-standing institutions or as schools within larger comprehensive research universities—increased their relative shares of federal funding (Geiger and Feller, 1995). They were able to capitalize on the openings of new scientific and technological frontiers associated with breakthrough advances in molecular biology and the life sciences; the increased funding for NIH, both in absolute terms and relative to that of other federal agencies; and the organizational and staffing patterns of academic medical centers, which permitted the hiring of additional research personnel essentially independent of undergraduate enrollment patterns.

The rapid rise to national standing of the University of Alabama-Birmingham from a branch campus to a nationally ranked, Research I institution based first on development of an academic medical center, and then leveraging of this strength to develop arts and sciences degrees highlights the potency of this strategy (Graham and Diamond, 1997, pp. 151–152). One can indeed find similar strategies underway at EPSCoR universities—as in the case of Marshall University, West Virginia, which has used the EPSCoR-supported enhancement of its biomedical research capabilities as an institutional template in seeking comparable improvements in its science and engineering programs.

Underpinning this strategy have been recent trends in the external funding of academic research. Between 1973 and 1996, the share of academic R&D directed to the medical sciences increased by over 5 percentage points, from 22.4 to 27.6 percent (National Science Foundation, 1999). This shift, using 1996 as the base, represents \$1.2 billion in research support to the medical sciences relative to other fields. Recently enacted increases in NIH's budget for FY1999, coupled with still active congressional proposals to achieve a doubling of NIH's budget in five years, attest to continuing strong political support for increases in medical and life science research. Even if the rosier of scenarios for NIH funding increases fails to materialize, it still appears likely that biomedical research will be treated at least as well if not better than most other scientific fields in congressional appropriations.

This strategy has two downsides. First, academic medical centers are expensive to establish and operate, making efforts to increase research competitiveness—even if successful—a financially questionable proposition for a university. Revenues from academic medical centers accounted for approximately 15 percent of total revenues for Research I and Research II universities in 1993, but were as high as 40 percent of revenues for universities with medical schools. The largest source of these revenues was medical services; indeed, “(b)y 1993, medical-service revenues accounted for over two and a half times more money than federal research grants to medical schools” (Cohen, 1997, p. 363).

However, cost control policies associated with the rise of managed health care and increased competition and changes in federal policies for reimbursing medical schools for their educational missions have had a twofold deleterious impact on the finances of academic medical schools. They have weakened the overall financial position of medical schools and closed off a channel by which clinical service income was used to subsidize research activities. Both trends are seen as serious threats to the ability of academic medical centers to maintain their existing levels of research (Association of American Medical Colleges, 1996).

Second, in many states, perceptions of excessive competition among existing hospitals—university-affiliated and non-university affiliated—may lead to a political gauntlet of opposing interests in securing state approval.

### **Bootstrap**

Bootstrapping is a more austere form of a niche strategy. It involves finding the resources from within the university to build research expertise. The strategy implies greater sacrifice in other institutional missions (e.g., educational programs) than the other strategies, and a longer time horizon before institutional expertise is built to nationally competitive levels. On the other hand, it yields greater self-determination in areas of research expertise to be developed, being somewhat less geared to short-term funding opportunities available from federal, state, or industrial sponsors.

Bootstrapping has two manifest shortcomings as a strategy. Even with concentrated focus, the institution may not be able to generate the internal resources necessary to achieve threshold levels of faculty and facilities to achieve research competitiveness. In addition, bootstrapping may not have the institutional staying power (in terms of leadership or faculty dedicated to both the objective of research competitiveness and the effectiveness of this strategy) to hew to the course of action implied by this strategy. Widespread and persistent austerity felt across many parts of a campus in the hopes of eventually making a few programs nationally competitive is a difficult strategy for an academic leader to implement.

### **Political Leverage**

Political leverage involves increased emphasis by university officials and state officials on using the influence of key members of the U.S. Congress to introduce explicit geographic distributive criteria into the allocation of federal academic research funds by federal agencies. This strategy converts episodic efforts to earmark selective federal research awards and the incremental building of requirements for EPSCoR programs among federal agencies into a broad-scale effort to introduce formula-based or quota-based criteria in lieu of peer-reviewed, merit-based scientific criteria into the allocation of federal academic research awards. The strategy essentially seeks to change the rules of competition.

The appeal of this strategy is heightened by the key leadership positions in the U.S. Congress currently held by representatives from EPSCoR states. Its appeal also may be enhanced over time if other strategies for increased competitiveness and excellence fail. In turning to political redress, EPSCoR institutions would be behaving like many other groups who find their interests not well served by competitive market processes and thus turn to government for regulatory or financial relief.

The drawbacks to this strategy are that it may stunt impetus for the reforms in policies, structures, and behaviors necessary to succeed in competitive environments. Earmarks also may deaden initiative within the university; they can become the antithesis of bet-

ter and bigger. The strategy also is likely to create opposition from members of Congress who represent states with universities that receive relatively large shares of federal academic R&D awards, from the scientific community, and from industrial and other communities which perceive that both their own sectors' and the national interests lie in insuring that the return from the public investment in academic R&D is maximized. Despite criticism of its shortcomings as well as expressions of unhappiness about the "distributively unfair" outcomes that it can produce (Chubin and Hackett, 1990), review by scientific peers is still regarded as the most effective resource allocation method to accomplish this end.

### **Strategic Redefinition of Objectives**

What if all the above strategies fail to enhance the research competitiveness of an institution? What if the impediments to improvement in research performance—low faculty salaries, inadequate equipment, indifferent political and financial support from state government or other stakeholders, competing institutional visions and priorities—are too formidable to overcome?

This possibility must be considered. Recent studies of the hierarchical structure of American research universities highlight this scenario. Geiger, for example, has observed that those universities with "good" rather than excellent research programs (as measured by NRC rankings) increased their share of external research funding during the 1980s, with promising prospects for the future; those institutions with programs ranked as adequate or below face "formidable hurdles as they seek to rise in the research hierarchy" (Geiger, 1996, p. 132). Moreover, he concludes, "Most will probably not succeed" (*loc. cit.*).

Essentially similar assessments are offered by Graham and Diamond (1997). The fourth tier of their four-tier ranking of the research and doctoral quality of institutions contains 51 institutions, many of which are "institutions of modest size and ambition that by dint of their history and location are unlikely to develop major research agendas" (Graham and Diamond, 1997, p. 161). Included in this group are the flagship universities in several EPSCoR states.

Graham and Diamond's history of the post-World War II period also points to unrealized aspirations by several universities that were unsuccessful in their efforts to make quantum quantitative and qualitative advances in research standing. Their lowest ranked quality tier contains a cluster of "relatively new urban branch campuses," as in Milwaukee, St. Louis, Dallas, Arlington, and New Orleans. These are institutions "where ambitions soared in the expansive 1960s, when service to urban constituencies was high on the national agenda" (p. 160).

What strategy(ies) exist for this possibility of unattained or unattainable objectives? One strategy, of course, is to work harder on any or all of the above strategies, or on finding a new, more potent approach. Another, however, is to engage in a strategic redefinition of objectives. Wildavsky, for example, in reviewing the course of public policy in areas such as crime, health, and education, has observed that when public objectives are unobtainable, agencies engage in a strategic retreat from objectives. Government agencies engage not only in trying to achieve objectives, but as these efforts fall short, in changing the objectives themselves. Agencies "negotiate between what they would have liked and what they can get, by finding either new objectives they can achieve for former clients or a new clientele that can use old objectives, or as a last resort, by transferring responsibility to other levels of government" (Wildavsky, 1979, p. 43).

Either purposively, based on analysis of the low probabilities of significantly enhancing research competitiveness or reactively, based on a period of unsuccessful endeavors to achieve such an enhancement, universities may seek to redefine their objectives. For many institutions (in both EPSCoR and non-EPSCoR states), this redefinition would likely take the form of increased attention to undergraduate education, master's level and professional education, and outreach. Significantly, such a redefinition would accord with calls from national leaders for an end to "research drift" and institutional compulsions to move up the Carnegie Classification hierarchy, and for public universities in particular to reemphasize undergraduate education and public service (Kellogg Commission, 1997).

The downside to this strategy is obvious. It requires institutions to accept lesser standings as research institutions on a perma-

ment basis. For some, it may in fact constitute a retreat, pulling back from a beachhead of recent advances in research standing to a toehold as something other than a strictly teaching and service institution. Academic administrators also must be wary about expressly articulating such a redefinition of objectives so that their institutions lose fewer research-active faculty to other more research-intensive institutions, and thus find themselves with even lower levels of research competitiveness.

## CONCLUSION

Strategy is a means of focusing attention and resources towards attainment of an objective. The objective considered in this paper is that of increased research competitiveness for federal research funds, the overarching objective of the NSF EPSCoR program. Each of the strategies presented (except, of course, the last one of strategic redefinition of objectives) singly or in combination holds some prospect of contributing to attainment of this objective. As noted, there is little that is novel in the strategies themselves; in fact, they are based primarily on information gathered during interviews with university presidents and other senior university administrators.

More important than the novelty or lack thereof of the listed strategies is that most, if not all, of them are equally available to all universities, EPSCoR and non-EPSCoR. Having an institutional strategy to enhance research competitiveness thus may be more effective than not having one (which itself is a “strategy,” purposively or by default, of leaving essentially in place existing university objectives, resource allocation algorithms, policies, practices, etc.). But having a strategy is no guarantee that it will lead to the attainment of the desired objective(s).

Here, clarification and specification of objectives become critical. All universities can improve the quality of their research, graduate, and undergraduate programs. All can increase the size of their research programs and, given continuous increases in federal funding of academic research, their absolute levels of federal academic R&D expenditures. Not all universities, however, can increase

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their relative shares (or rankings) of federal R&D expenditures. Whatever the care, thoughtfulness, or leadership exercised in selecting (and implementing) strategies to increase research competitiveness, it is not possible for all current and aspiring research-oriented universities to achieve their objectives of relative improvement.

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