

CHAPTER 6

RESEARCH

INTRODUCTION

Ernest L. Boyer's *Scholarship Reconsidered*, a 1990 publication of the Carnegie Foundation for the Advancement of Teaching, often is cited as a powerful statement in favor of replacing the emphasis on research and publication within higher education with a renewed emphasis on undergraduate education. However, a frequently overlooked passage in Boyer's book offers the following recommendation regarding faculty emphases within research universities such as the University of Kentucky.

At the *research university*, original research and publication should remain the basic expectations and be considered the key criteria by which the performance of most faculty will be assessed. Where else but in our major research universities—with their intellectual and physical resources and their tradition of rigorous and untrammelled inquiry—should the bulk of research in a free society be conducted and rewarded? (p. 57)

Research also plays a central role in the formally adopted objectives of the University of Kentucky Self-Study. The first objective of the Self-Study is as follows:

To evaluate the effectiveness of the University of Kentucky in fulfilling its mission as the Commonwealth's principal and only statewide institution for instruction, research and public service, nationally recognized for the quality of its scholarship, research, and graduates.

Why this emphasis on research in an institution such as the University of Kentucky? The role of the contemporary university in transmitting knowledge to its students is understood by all informed observers, but the obligation of a statewide institution such as the University of Kentucky to *extend* knowledge is less widely understood. Even as the members of a University faculty are engaged in communicating existing knowledge to their students, they are expected to be adding to the body of human knowledge, seeking new information and expanded understanding. Universities, in fact, are unique in their approach to the expansion of knowledge. While many government agencies and corporations conduct research that is oriented around the solution of specific problems defined by the leadership of those organizations, university research is intended to expand knowledge for its ultimate value as well as for its immediate use.

The knowledge generated by university faculty is frequently of great usefulness, but the importance of university research goes beyond short-term practical consequences. Universities differ from other organizations in that human curiosity itself is a major force underlying its research activities. Because such research is being conducted, corporate and governmental entities facing unanticipated problems are often able to draw on an accumulated body of knowledge that would be unavailable were it not for the basic research activities of a university faculty. Even if the knowledge generated by a university research project never results in a new patent or the solution of a specific problem confronted by a government agency, it remains valuable because it

allows us to satisfy our need as human beings to expand our understanding of the physical, biological, and social world of which we are a part. Only university research is likely to satisfy this fundamental need.

The expansion of human knowledge is central to the mission of any university that is engaged in research and graduate education. However, the research activities of a university faculty pay important dividends in other areas. Because of the existence within a university of faculty, professional staff, and facilities that provide the human and physical infrastructure for research, corporate and government personnel who are confronting particular problems are able to draw on the expertise and facilities of the university in an effort to solve these problems. Thus, any state that fails to cultivate the research expertise and facilities of its leading university is placing its industrial, agricultural, and governmental organizations at a disadvantage.

Under appropriate administrative and reward systems, an active research faculty also works to the advantage of students, including undergraduates. As students embark on their later careers, they will be affected by many changes caused by vast technological, cultural, and economic forces impinging upon our society. Because they will be contending with a dynamic and possibly inhospitable social, political, and economic environment, it is important that they understand how to interpret and to adjust to the changes with which they are confronted. Their success in dealing with the situations they will face will depend in large part on the quality of their academic preparation. Their course work and other academic experiences should have given them more than knowledge and information. Because some of the specific facts transmitted to students can very quickly become obsolete, it is perhaps more important that they learn how to receive and evaluate new information. To the extent that they work with faculty and other instructors who are themselves engaged in a quest for truth, students will develop an ability to think and learn. Because students in a research university are introduced to a body of knowledge by individuals who are themselves contributing to the development of that body of knowledge, they are in an unusual position to develop an understanding of the habits of intellectual inquiry that will serve them well throughout the period following their graduation. Indeed, this is a major reason why a bright student should give serious consideration to enrolling in a research university.

Faculty and graduate students with teaching assignments should be expected to devote considerable skill and energy to the effective instruction of their students. However, their instruction will be more valuable to the extent that the instructors are themselves intellectually engaged in scholarship. For this reason, the administration of a research university fulfills its obligations to its faculty and students only to the extent that it provides the facilities, administrative arrangements, and reward systems that are necessary to encourage and expedite research activities. This chapter's evaluation of the research climate and activities of the University of Kentucky therefore speaks to the heart of the unique role of the University in relation to the citizens of the Commonwealth as well as its faculty and students.

The University of Kentucky Self-Study Research Committee was charged to:

1. Review the research program and mission, and review the procedures for evaluating the quality, productivity, and effectiveness of the program as well as the environment for conducting research within departments, colleges, the University, and the state.
2. Review the definition of what constitutes research and assess the role of faculty, research staff, and graduate students in research.

3. Review the role of research institutes and centers in research.

The Research Committee elected to define research in the broadest of terms including the entire range of scholarly activities leading to the development of knowledge. As the land grant institution in the Commonwealth, scholarly activity is both rich and diverse. Performing and creative arts, the authorship of empirically and theoretically based manuscripts, and traditional bench and applied research constitute the research enterprise. This report examines, analyzes, and reports the status of research at the University of Kentucky.

The Research Committee established four subcommittees to address the scope of the charge: Administrative Subcommittee; Centers and Institutes Subcommittee; Evaluation and Rewards Subcommittee; and the Infrastructure Subcommittee. Each subcommittee formulated questions to guide their work and developed methods to seek information. The Chair, Vice Chair, and subcommittee chairs met regularly to share information, findings, provide direction, and to ensure that all aspects of the research endeavor would be examined. This structure and process served the committee well. The subcommittees reviewed and analyzed numerous written materials (Appendix 6-M). In addition, approximately 500 administrators, faculty, and staff were involved in discussions about the research enterprise at the University of Kentucky (Appendix 6-N). The following findings and recommendations reflect the complexity and diversity of research at the University of Kentucky.

UK RESEARCH ACCOMPLISHMENTS, 1981-1991

In order to understand the current context and status of research, it is appropriate to review some of the major accomplishments that have occurred during the past decade. The following list of accomplishments indicates that the University of Kentucky has made significant strides in meeting its research mission.

- * Since 1981, the University has increased its total federal funding from \$29 million to \$62 million. Federally sponsored Research and Development has grown from \$14 million in fiscal year 1981 to \$27 million in fiscal year 1989 representing an increase of 93 percent (as reported by the National Science Foundation). Compared to its benchmark institutions, the University of Kentucky enjoyed relatively rapid growth (Appendix 6-A and 6-B).
- * Since 1981, there has been an increase in graduate student enrollment from 3,535 in 1981 to 4,900 in 1991 (Appendix 6-C). Graduate student enrollment as a percentage of the total student population has increased from 15.1 percent in 1981 to 20.2 percent in 1991.
- * The 1986 Kentucky General Assembly selected the University of Kentucky as the site for the location and administration of the Commonwealth's Supercomputer Facility, a statewide resource to provide high performance scientific computing services to Kentucky's universities, industries, and federal, state, and local government agencies.
- * The Center for Computational Sciences was established in 1986 as a Center for Excellence to support computationally intensive research.

- * In 1986 the Kentucky General Assembly funded the \$10 million Center for Robotics and Manufacturing Systems which conducts research related to manufacturing and automation. The Center houses engineering extension and education programs which transfer new knowledge to the private sector of the Commonwealth.
- * The 1986 General Assembly approved a \$20 million bond issue to purchase new research equipment at the University of Kentucky.
- * In October 1986, the Commonwealth of Kentucky received a five-year, \$3 million award from the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCOR) to build basic sciences and engineering research in Kentucky. The University of Kentucky was responsible for the direction of 12 of the 15 component projects. The success of the first phase was recognized in 1991 when a second competitive EPSCOR project was funded by the National Science Foundation.
- * In 1987, the University of Kentucky was classified as a Research University I by the Carnegie Foundation, placing the University of Kentucky among the top 45 public research institutions in the nation.
- * In fiscal year 1988, industry support for UK research totaled \$6.3 million, which was 11.5 percent of the total Research and Development expenditures, thereby ranking the University of Kentucky twelfth in the nation in industrial funding as a percentage of total funding according to data provided by the National Science Foundation.
- * In 1988, the University of Kentucky established the Office of the Vice President for Research and Graduate Studies to provide overall leadership and administrative oversight for the research and graduate education activities of the University.
- * In fiscal year 1989 in addition to the \$27 million for research and development, the University received \$11 million for facilities, equipment and traineeships/fellowships and \$24 million in nonscience/engineering support for education and service activities (Appendix 6-D, E, F). This funding pattern reflects the University's commitment to research, education and service and the faculty's ability to attract funding to accomplish the overall mission of the institution.
- * Since 1989 the University of Kentucky has received \$9 million (three of four phases have been funded) in direct appropriations from the Economic Development Administration to develop the Applied Science and Technology Commercialization Center (ASTeCC). ASTeCC will serve as a model demonstration center dedicated to promoting the more rapid dissemination and absorption of emerging technologies. The Advanced Science and Technology Commercialization Center will be composed of seven distinct, yet interrelated, multidisciplinary groups engaged in basic research, applied research and development, and technology transfer.
- * In 1990, the University awarded 191 doctoral degrees (63 to women), 824 masters degrees (491 to women) and 7 specialist degrees (5 to women) (Appendix 6-G). Approximately 1500 students were enrolled in Doctoral programs and 2500 students were enrolled in masters degree programs in 1990 (Appendix 6-H). The University has actively recruited minorities and women in underrepresented areas and has had a measure of success in this effort (Appendix 6-I, J and K).

- * The \$6.3 million Singletary Center for the Arts houses the 20,000 square foot University of Kentucky Art Museum with a collection of over 3,000 paintings and art objects. For the last ten years the Center provided state-of-the-art performance facilities for UK students and faculty.
- * Although not studied during the last review, the University of Kentucky currently has approximately 26 multidisciplinary research centers and institutes formally approved by the University of Kentucky Board of Trustees. An additional 29 multidisciplinary research programs operate within academic units. Collectively, these centers and institutes provide the necessary infrastructure to bridge traditional departmental and disciplinary boundaries (Appendix 6-L).
- * The University of Kentucky's current level of extramural activity involves more than 1,300 projects, with budgets totaling over \$142 million (Exhibit 6-A).

Implicit in the University's land-grant mission is the recognition that research is inseparable from education and service. An excellent example of this is demonstrated by the Center for Rural Health which was opened by the Medical Center in 1990. With headquarters in Hazard, Kentucky, the Center conducts research in rural health policy, oversees a family practice residency program, offers a master of science degree in nursing, established an emergency medicine clinical residency program in rural regional hospitals, established bachelor's degree programs in nursing, physical therapy and lab technology, and provides continuing education for rural health care professionals. As a result of this initiative, UK faculty from over 20 departments and Centers have formed the Rural Health Research Interest Group which has grown to include faculty, students and staff from UK and researchers from outside the institution. This group is exploring new research possibilities in the area of rural health.

A second example of the integration of teaching, research and service is provided by the Sanders-Brown Center on Aging. It is an internationally known multidisciplinary center for gerontological teaching, research, and service dedicated to improving the quality of life for older adults. Over 150 faculty and staff from many areas of the University are involved in programs of the Center.

The University has expanded its role in technology transfer over the last ten years through service oriented programs which provide critical information for government and industry. In addition to the Agricultural Extension Service and the Engineering Extension program of the Center for Robotics and Manufacturing Systems, a number of departments, centers and institutes are engaged in transferring new knowledge to the private sector including:

- * The Kentucky Transportation Center serves as the state center for interdisciplinary transportation research and has an aggressive program of education and technology transfer throughout the state with a newsletter, seminars, workshops, and individual consultation.
- * The Maxwell H. Gluck Equine Research Center provides research in many disciplines of veterinary science. Fields of research include motion analysis utilizing high-speed video and computer modeling, ultrastructural pathology and anatomy, reproductive physiology, immuno-genetics, parasitology, infectious diseases, and epidemiology.

- * The Interdisciplinary Human Development Institute develops and provides interdisciplinary research, training and technical assistance focused on information services and model programs and policies. The Institute seeks to enhance life opportunities for people with disabilities, and their families.
- * The Center for Business and Economics Research analyzes the trends in the economy of Kentucky and provides economic data to state agencies, area development districts, and individuals.
- * The Graduate Center for Biomedical Engineering conducts research focused upon the principles and practices of engineering to the solution of problems in medicine and biology.
- * The Small Business Development Center provides a broad range of services to small businesses.
- * The Center for Applied Energy Research focuses on areas such as synthetic fuels, direct combustion, resource characterization, and mining—all critical to the energy industry in Kentucky.
- * The Center for Pharmaceutical Science and Technology conducts research devoted to drug product development and evaluation in cooperation with established and emerging pharmaceutical and biotechnology firms.
- * The University has been active in working with the Kentucky Cabinet for Economic Development and the Kentucky Science and Technology Council to develop the plan for the Kentucky Technology Service—a comprehensive technology assistance and transfer network for the Commonwealth.

A landmark example of research having a direct impact on the economic well-being of the Commonwealth is the development of the vaccine for equine herpesvirus 1. Over the past 50-60 years, several generations of vaccines have been developed at the University of Kentucky's Department of Veterinary Science to protect against abortion in mares caused by equine herpesvirus 1. Early experimental vaccines were associated with undesirable local and systemic side effects and were relatively ineffective in preventing abortion. The introduction of an improved inactivated adjuvanted vaccine in the late 1970s that was later commercially produced by Ft. Dodge Laboratories (Pneumabort-K) heralded a significant improvement in vaccine efficacy. With the widespread use of the vaccine among the Thoroughbred broodmare population in central Kentucky, the number of herpesvirus abortions fell from an average of 7.4 per 1,000 pregnant mares during the period 1957 to 1979 to 2.9 per 1,000 pregnant mares between 1980 and 1983. The average fell further during the most recent five-year period for which records are available (1984 to 1988) to a figure of 1.7 abortions per 1,000 pregnant mares. The decline in the rate of herpesvirus abortions during the 1980s coincided with a time when, in fact, there was a significant increase in the size of the Thoroughbred broodmare population in Kentucky. The foregoing is a clear-cut example of the practical relevance and impact that research undertaken at the University of Kentucky's Department of Veterinary Science has had on one of the most important sectors of the state's agricultural industry.

The University also communicates research findings through the efforts of various units to publicize their research activities outside the institution. Perhaps the most visible mechanism for

this has been *Odyssey*, a magazine published by the Office of the Vice President for Research and Graduate Studies (Exhibit 6-B). This award-winning publication focuses on the scholarly achievements of the faculty and staff of the University. It is targeted to a lay audience and is sent to alumni, state legislators, business and industry, state libraries, and other news outlets.

A second noteworthy attempt to educate Kentuckians about the importance of research to their daily lives is *UK Science & You* (Exhibit 6-C). The Office of the Vice President for Research and Graduate Studies sends camera-ready articles with photographs/graphics to 95 percent of the weekly newspapers in Kentucky. These articles reach a readership of over 400,000 people. Attached to this report are examples of the articles including:

Lunch in the Mine describes the research of anthropologist Sara Quandt, who is studying the nutrition of coal miners.

Kentucky Women: Life Below the Poverty Line focuses on the work of Carol Straus and Lucinda Zoe (Center for Business and Economic Research), which documents the economic hardships of many Kentucky women.

Trains that Float, Cars that Glide translates superconductivity research into practical meaning.

Kentucky Teens Earning While They Learn describes the programs at UK which encourage undergraduates to become involved in research.

Women in the Coal Camps discusses the research of Glenna Graves, a doctoral student in History, who tells the story of women in Johnson and Floyd counties.

Turning Coal into Oil explains why liquification research may be of future economic benefit to Kentucky.

Tracking the Motion of Thoroughbreds discusses how research in biomechanics of horses affects one of Kentucky's most important industries.

Teaching Mine Safety highlights the work of the multidisciplinary Behavioral Research Aspects of Safety and Health working group in developing innovative techniques for mine safety training.

Why Do Teenagers Keep Saying Yes to Alcohol? describes the research of psychologist Greg Smith, who has found some answers to the question.

Fighting Fire with Technology: A Robot to the Rescue? focuses on the efforts of scientists and engineers at the UK Center for Robotics and Manufacturing Systems to build just such a robot.

To Buy or Not to Buy: That is the Question explains the work of Behavioral Science postdoctoral fellow Mitzi Johnson, who is examining decision-making in older adults.

UK's Genetic Detective describes dysmorphologist Bryan Hall's work in recognizing physical abnormalities and their relationship to a genetic problem and counseling families with inherited disorders.

These articles cover the broad range of scholarly activity that is undertaken at the University and often focus on important institutional priorities such as the recruitment of underrepresented and minority students and faculty, involvement of undergraduates in research, services provided by the University, the role of research in teaching and learning, and UK's role in economic development.

The University of Kentucky has clearly experienced rapid growth and development in accomplishing its research mission. However, the emphasis on research productivity, the acquisition of externally funded grants and contracts, the increase in technology transfer and economic development efforts has outpaced the University's resources available to meet these demands. The University of Kentucky must plan for future growth and build upon what it has accomplished. This Self-Study offers the opportunity to move into the next phase of growth in research development at the University of Kentucky.

ADMINISTRATIVE SUPPORT

To examine how well the University of Kentucky, as an institution, supports research, three questions guided the inquiry:

1. What is the University of Kentucky doing well to support research?
2. What is the University of Kentucky not doing well to support research?
3. What should the University of Kentucky do to improve institutional support for research?

These questions were developed to elicit a broad range of open-ended responses to provide maximum freedom in identifying major issues critical to the continued growth of the University in the area of research.

A concerted effort was made to be as inclusive as possible in collecting data to reflect the strengths and weaknesses of the total University. In addition, the committee provided a forum for faculty and administrators to voice their concerns. In analyzing the data collected, the subcommittee has formulated areas of consensus in order to make recommendations at a University-wide level. The following discussion highlights the issues raised by faculty and administration across the University. The three major areas of concern that emerged include (1) communication and planning, (2) faculty and support services, and (3) funding.

Communication and Planning

The strategic planning process was addressed in many discussions, often in colorful terms. The recurring problem addressed by faculty and administrators involved the lack of vertical feedback and horizontal communication. This was found to be particularly troublesome in the recruitment of new faculty, allocation of resources, and facility expansion. The University must modify the strategic planning process to allow horizontal integration of research objectives and priorities across units. That is, departments and colleges need to be aware of the research objectives of other like units within the University and take into account common areas of strength in the planning process. Additional vertical feedback is needed to assist units in focusing their objectives and activities. Currently, while the planning process flows from the unit level up through the structure of the institution, there is little or no top-down feedback to units.

Units/sectors must move in the same direction via short and long term planning. Communication regarding integrated planning for all units must be improved. Coordinated resource use must be promoted. For example, program needs and priorities must be considered in the major equipment decision-making process. The addition of faculty lines needs to coincide with program goals.

Recommendation 6-1: The University should expand efforts to communicate to Kentuckians the importance of UK research to the Commonwealth.

Recommendation 6-2: The University should incorporate adequate new faculty start-up resource allocation in the program and financial planning process for all units.

Recommendation 6-3: The University should implement the recommendations of the Status of Women Report to increase the numbers of women researchers and to recognize the value of research by women and about women.

Recommendation 6-4: The University should implement the recommendations of the Ad Hoc Committee on Minorities Report to attract minority researchers to the University and to recognize the value of research about minorities.

Recommendation 6-5: The University should develop a building plan consistent with existing and future expectations for research development to ensure adequate research space.

Recommendation 6-6: The University should advocate and encourage faculty research within departments and within multidisciplinary research centers and institutes.

Recommendation 6-7: The University should improve both horizontal (lateral - across units) and vertical (top down and bottom up) communication.

Recommendation 6-8: The University should coordinate internal planning among all units, with cross-communication of goals and objectives among sectors, units and centers/institutes.

Recommendation 6-9: The University should modify the strategic planning process to allow for lateral integration of research objectives and priorities across units without regard to sector boundaries.

Recommendation 6-10: The University should plan for the regular and systematic upgrade and/or replacement of major research equipment and the continued maintenance and operation of the equipment.

Recommendation 6-11: Faculty distribution of effort should accurately reflect actual effort, e.g., teaching, research, clinical practice/service.

Faculty and Support Services

A recurring theme heard from most of the faculty and many administrators centered around the need to attract and retain high quality research assistants, postdoctoral students, and technicians. These individuals are a critical part of the research enterprise and the faculty related numerous examples of how the loss of a key technician or student can be detrimental to research. Some units reported that stipend levels were not competitive in their field. There was consensus that the institution must address the inequity in the treatment of out-of-state tuition for research assistants. Out-of-state students receive a tuition scholarship for the out-of-state portion of their fees while the in-state students receive no equal adjustment.

The University of Kentucky does not consistently provide faculty development opportunities that enhance research expertise. A formal mentoring program and discipline-specific assistance in locating, developing and pursuing grant opportunities would aid in this effort. The University should enhance incentives for research and grants. Acknowledgement of efforts to obtain grants should be incorporated into the merit review process.

Few units reported having adequate research facilities. Space is a major problem at this University just as it is on many other campuses. Some faculty and administrators suggested that there would be less of a problem if the allocation of space were based more on demonstrated need rather than entitlement. Others stated that there was no solution short of finding new space.

Recommendation 6-12: The University should eliminate the designation of research (RA) and teaching (TA) assistantships and award graduate assistantships (GA) to be utilized by the department to meet its goals in teaching and research. Full tuition remission should be provided to all GAs, both those supported by the institution and those supported by extramural grants and contracts.

Recommendation 6-13: The University should expand access to computers in the mid-size range, and increase the availability of high speed connections for scientific computing to support research.

Recommendation 6-14: The University should fully fund the internally-funded portions of sabbatical and faculty research award opportunities.

Recommendation 6-15: The University should appoint a faculty advisory committee to meet quarterly with the responsible officers of research service units to establish a dialogue and encourage operational changes that expedite the research mission of the institution. These service units such as purchasing, physical plant, personnel, OSPA, OSPD, and Research Accounting should develop an "end-user" orientation. Each service unit should have an "ombud" contact person for problems and concerns relating to research.

Recommendation 6-16: The University should initiate a recruitment program for highly qualified new graduate students, similar to the program being used to recruit top-ranking undergraduates. Expand incentives for GA campus visits, appointments, and fellowships.

Recommendation 6-17: The University should expand the pool of potential laboratory assistants by instituting programs to keep talented undergraduates at the University of Kentucky for graduate work.

Recommendation 6-18: The University should develop an accounting system which supports departmental and project research accounts.

Funding

Faculty and administrators voiced the concern that budgetary support is not currently adequate for the expanding research mission of the University. Nowhere is this more evident than in the area of current operating expenses. The lack of current operating expenses is having a detrimental effect on scholarly productivity, especially in those units where it is not possible to develop other sources of income.

Many faculty expressed ignorance about the University of Kentucky Research Foundation budget and the programs which are funded from the recovery of indirect costs. Deans expressed frustration at the lack of coordination and communication concerning internally funded programs. Some faculty, who are knowledgeable of the system, circumvent their chairs and deans in attracting internal funds. Some examples of this were given in which the dean or chair would not have given the particular activity a very high priority relative to other unit priorities. Other examples described faculty receiving funds for the same project from more than one source without the funding unit's knowledge.

Virtually every group (faculty and administrators) indicated that they wanted more indirect cost recovery dollars. This was seen by many as a flexible group of funds which could be used to enhance programs at a time when various "taxes" and/or reallocation programs (e.g. vacancy credit and the Lexington Campus Innovation and Excellence Program) have taken away financial flexibility. This was also mentioned by administrators in the context of an uncertain future for indirect cost recovery based upon current events in Congress and federal agencies. Other faculty expressed concern over the issue of using nonrecurring funds for recurring cost items (e.g., funding the debt service on the biomedical research building). In a time of tight budgets, there was consensus among administrators that the University must set priorities to maximize the skills and abilities of the faculty and to take full advantage of federal funding priorities. There was also a concern about the lack of funding in some areas that traditionally cannot attract external support. Even the well-funded faculty recognized the need to support activity in these areas internally.

All groups noted problems with the purchase, maintenance, and operating costs of equipment. The University has an equipment inventory of over \$175 million. In fiscal year 1990, \$43.7 million of that equipment had exceeded its life expectancy and by fiscal year 94, a total of \$90 million of that equipment will have exceeded its life expectancy. There was almost complete agreement that the 1986 equipment bond issue was a major factor in improving the extramural research grant and contract competitiveness of the faculty. A number of suggestions were made with regard to the maintenance and operational costs including decentralized funding, centralized funding, and combinations of the two. The University of Kentucky should develop plans to support the purchase of new equipment. An innovative plan to insure the continued maintenance and operation of equipment resources should be part of any new initiatives.

Many faculty and administrators raised the issue of start-up funds for new faculty. Some units reported that they had virtually no start-up funds, others reported adequate start-up resources, and still other units reported that competitive start-up packages were well beyond their unit and college capabilities. Clearly, without adequate start-up resources, the University cannot continue to attract high quality faculty. The University of Kentucky must incorporate adequate start-up resource allocation into the program and financial planning process for all academic units. The University needs to be able to maintain adequate flexibility to be competitive for high quality faculty in those areas that are determined to be of high priority.

Recommendation 6-19: The University should provide competitive salaries for technicians and support personnel.

Recommendation 6-20: The University should provide all faculty access to the high speed data communications network. Central funds should be made available to accomplish this goal. Support staff should be available to work with departments.

Recommendation 6-21: The University should return all indirect cost recovery dollars to support faculty research.

Recommendation 6-22: The University should seek an increase in state support for research in the institution's budget.

Recommendation 6-23: The University should fund renovations, maintenance, and health/safety upgrades of buildings and laboratories at the university level, rather than at the unit/department level.

Recommendation 6-24: The University should eliminate the use of indirect cost recovery dollars for recurring cost items.

Recommendation 6-25: The University should fund travel support for all faculty, especially untenured junior faculty.

Recommendation 6-26: The University should recognize and support the research needs and objectives in the arts, humanities, and social sciences by assisting financially those disciplines and units which have few opportunities for extramural support.

MULTIDISCIPLINARY CENTERS AND INSTITUTES

The 1981 Self-Study did not examine the role and missions of Multidisciplinary Centers and Institutes (MCIs) at the University of Kentucky. The 1991 inquiry provides a baseline set of observations and information that might serve to identify issues and raise as well as answer questions.

The inquiry attempted to describe the types of MCIs at the University of Kentucky, determine the frequency and reasons for faculty involvement in MCIs, and to seek information

about four questions concerning center and institute roles, missions, success, facilitating factors, and impediments. The specific questions were:

1. What is the role and mission of MCIs at the University of Kentucky?
2. What criteria should be used to judge the success of MCIs? Why?
3. To what degree have MCIs been successful or unsuccessful at Kentucky?
4. What facilitating factors, resources, needs, obstacles, etc., contribute to the success or failure of MCIs in carrying out their missions?

Three sets of findings emerged. These include (1) the types and administrative locations of MCIs; (2) the frequency of and reasons for faculty involvement in MCIs, and (3) views of top university sector administrators, MCI directors and others about the role, missions, and effectiveness of MCIs.

Number and Varieties of MCIs

The University of Kentucky's publication on *Research Infrastructure* lists 55 research centers and programs, 13 instrumentation facilities, and 11 administrative and support service offices that facilitate research (Exhibit 6-D). The 55 research centers and programs were the focus of this inquiry. These centers and programs tend to be multidisciplinary research units. These MCIs generally fall into one of four types of organizational structures. These include:

1. Faculty Working Groups with no administrative structure other than the usual department and college administration of the individual faculty members involved. These groups typically make no demands for space, resources, and equipment that cannot be accommodated by their respective academic departments and colleges. The faculty typically fund their research through a combination of internal University of Kentucky research proposals and extramural agency proposals.
2. Centers and Institutes housed within colleges and departments that report to a college dean or a department chairperson. Sometimes such centers or institutes emerge and are supported by a combined university and outside constituency that arranges for new state, federal, or private funds to support the center. Such centers usually generate additional extramural research grants and contracts.
3. Graduate degree granting centers and institutes that report to the Dean of the Graduate School, and in three cases to the Vice President for Research and Graduate Studies as well. Most of these interdisciplinary degree programs grew from faculty working groups and gradually developed into new multidisciplinary graduate degree programs. Seven MCIs of this type exist. Their main mission is graduate education.
4. Centers and Institutes that cross sectors, colleges, and departments and that report to the Vice President for Research and Graduate Studies. The 1991 *Research Infrastructure* lists 22 MCIs in this category. Their main mission is research and service funded primarily by extramural grants and contracts. Nineteen centers and institutes in this group of 22 do not offer formal graduate courses and programs. However, these Centers and Institutes provide major financial support for graduate students and faculty, and many opportunities for both faculty and graduate student research.

Faculty Involvement and Perceptions

Twenty percent of the 634 respondents to a faculty survey reported they are currently involved in an MCI, and an additional 3 percent report past involvement. The modal percent of effort dedicated to MCI work is 5 percent (21 percent of respondents) with another 15 percent devoting 10 percent effort. About 10 percent of the respondents reported a 50 percent effort devoted to MCIs. Most faculty tend to be involved in well-organized formal MCIs that receive some core support from the University.

Sixteen percent of the respondents agreed that pressure from departmental and college peers and administrators had influenced them to avoid MCI involvement. Of those faculty involved with MCIs, only 12 percent agreed that they had been pressured not to be involved. Of those faculty without involvement in MCIs, 20 percent agreed that they had been pressured not to be involved with MCIs.

Overall more than 10 percent of the faculty see MCIs as the unit most supportive of research seed money, access to research facilities and space, and assistance in getting research funded. Overall the majority of faculty (28%) surveyed see MCIs as the most supportive unit facilitating multidisciplinary research. Departments and colleges received the next highest nominations (24% each). Only one percent of the faculty surveyed agreed that involvement in an MCI isolated them from their department colleagues or interfered with their regular departmental teaching and other work.

Responses to all survey questions were also compared for men and women and for members of minorities. There are no discernible differences in participation in MCIs, pressure to avoid involvement, or any other factor on the basis of gender or minority status.

Administrator Perceptions of MCI Role and Mission

The subcommittee interviewed the University President, Chancellors of the Lexington Campus and the Medical Center, their Vice Chancellors for Research, the present, past, and the Acting Vice President for Research and Graduate Studies, the Assistant Vice President, the present and former Dean of the Graduate School, the directors of the 22 MCIs that report to the VP-RGS, and the directors and others associated with 8 additional MCIs. They were asked four common questions concerning role, mission, criteria for success, facilitating factors, and impediments to MCIs.

A number of perceptions, concerns, agreements, and disagreements emerged from these interviews. The primary issues include:

- * relevance of MCI mission with respect to University goals and mission
- * merit of MCI activities and products (academic, ethical, social, practical)
- * criteria and procedures for evaluation of MCIs as units of the university
- * faculty activity within MCIs (percent effort, monitoring, performance evaluation, and academic tenure and promotion)

- * reporting lines and administrative oversight for the MCIs
- * financial costs/benefits of MCIs
- * indirect cost incentive fund distribution to academic departments, colleges, MCIs, and University sectors for faculty efforts within MCIs and departments.

Nearly all persons interviewed agreed that MCIs represent a major trend that is likely to continue, and that MCIs provide opportunities for funding of research, service, and technology transfer in complex areas of disciplinary overlap that traditional academic departments are less able to meet. All groups also felt that MCI activity can support worthwhile graduate student education and faculty research. Academic sector administrators tend to see less necessity for MCIs to operate outside the usual departmental and college administrative structures. MCIs and RGS administrators tend to see the need for MCIs that operate across departments, colleges, and sectors because of the interdisciplinary nature of the work.

All persons interviewed felt that better collaboration is needed among center directors, staff, and the VP-RGS and academic department chairs, college deans, and chancellors to conceptualize, plan, implement, and support MCI missions, and to evaluate their effectiveness. The chancellors and vice chancellors feel that the VP-RGS has sometimes interacted directly with MCI directors and faculty members and failed to inform chancellors and academic deans and chairs about the activities of faculty involved in MCIs.

There is tension between MCIs and other units (primarily academic sectors and departments) with respect to access to resources such as faculty time, dollars (including state funds to MCIs), and space. MCIs are sometimes seen as competing directly with academic departments for these resources, and as stimulating interdisciplinary research when the development needs of a department and college may lie in other directions.

Differences of opinion were expressed concerning the actual cost versus the actual return of funds from the activities of MCIs. Examination of funding data suggest a conservative estimate that the 22 MCIs that report to the VP-RGS return approximately \$1.50 of additional outside funds for each University dollar invested in these programs. The actual rate of return is thought to be much higher by directors of MCIs and some other persons. The present record-keeping system makes it difficult to make this estimate. The system ignores multiplier effects of MCIs where work done by the MCI attracts new and regular recurring funds for the University that would not otherwise be available, and that initiates and supports faculty research that otherwise would not be undertaken.

All persons interviewed tended to agree that MCIs should primarily be self-supporting in terms of their operating cost, with small proportions of their budget and resources being supplied by the University as is appropriate under the indirect costs associated with the extramural, funded R & D conducted by MCIs.

MCI directors reported frustration with attempts to work with academic departments in the recruitment of top researchers, and the appointment of these researchers as faculty members within academic departments. Joint recruitment may be actively avoided by department chairs who are concerned with allocation of faculty time to departmental activities. At many other major research universities, academic departments and sectors collaborate with MCIs to recruit outstanding faculty and graduate students, and to strengthen graduate degree programs.

Recommendation 6-27: The University should review and document the research administration structure, relationships, roles, and chain of command among the Vice Chancellors for Research, the Vice President for Research and Graduate Studies, Chancellors, deans, associate deans for research, the Dean of the Graduate School, and the centers and institute directors.

Recommendation 6-28: The University should increase cooperation and communication among sector administrators, deans, multidisciplinary centers and institute directors, and department chairs to facilitate:

- * faculty research
- * graduate student support
- * recruitment of outstanding faculty and graduate students researchers
- * increased extramural funding
- * better integration of research missions across colleges, centers and institutes, and departments

Recommendation 6-29: The University should review and document the relationships and mutual contributions among centers and institutes and departments in terms of:

- * faculty research activity
- * graduate student support
- * better estimates of the cost/benefit ratio of centers and institutes to the university mission

FACULTY EVALUATION AND REWARD

The University's infrastructure for rewarding faculty research is generally effective. The University's sabbatical leave policy provides individual faculty the time to pursue research projects without the normal teaching obligations. Moreover, the University Research Professor award program and other award programs promote faculty research on the campus. In addition, non-university incentive funds generated for research projects are partially returned to the generating department to reward their research initiatives.

The Self-Study Survey indicates that 88 percent of the faculty have a research component in their appointment. Eighty-six percent of the faculty responding to the survey believe that their academic unit is committed to research. The survey also shows that faculty perceive that they get more support for their research from their particular academic unit than from the central university administration.

However, the one area of central administration receiving high marks from respondents was the Office of Sponsored Projects. Well over half of those responding to the survey indicated general satisfaction with the assistance provided to faculty researchers by the Office of Sponsored Program Development and the Office of Sponsored Project Administration.

Among some women faculty there is a perception that discrepancies exist in the distribution of resources between women and men faculty. Those attending the women's focus group believe

that women/gender research topics are devalued by their colleagues and that cooperative research among women is not rewarded. The Research Committee is cognizant of this perception and of the problems highlighted in the Report on the Status of Women of 1991 (Exhibit AA). Efforts should be focused on increasing numbers of women faculty engaged in research and women appointed as academic administrators. Women should be assured of equal access to resources and equitable participation in the evaluation and reward process. The Winter/Spring 1992 issue of *Odyssey* featured an article on "Close-Up on Women in Science" which discussed the opportunities and challenges women face in science careers (Exhibit 6-B).

The focus group for minority faculty also pointed to a perception of problems in the area of faculty research. Faculty noted the continuing need to include minority participation in funded research projects. A mentoring program for minority researchers should be developed. Similar to women's concerns about devaluation of research topics, research on minority issues must receive equal value in the evaluation and reward process. The University should build upon its commitments in the area of minority faculty representation in teaching, research, and service. The Committee supports the recommendations of the 1990 *Ad Hoc* Committee on Minorities (Exhibit AB). Research related to cultural diversity should be recognized and given equal weight in the evaluation and reward process.

RESEARCH SUPPORT INFRASTRUCTURE

The research support infrastructure includes those departments, services, and facilities (and associated policies and procedures) which provide principal support services, both administrative and academic, to research activities. The intent of this Committee was to establish a baseline set of observations and information, both anecdotal and empirical, which would serve as the basis for inquiry and recommendations. Questions addressed in this area included:

1. What were the deficits in the infrastructure cited in the 1980 Self-Study Report?
2. What has occurred during the past decade to strengthen the research infrastructure?
3. What problems and solutions can be identified as a result of this self study?

The previous (1980) Self-Study Report identified five problem areas related to the University research support infrastructure.

1. Increase "seed money" to support research efforts of new faculty and faculty in departments where extramural funds are limited.

Since 1980, concerted effort has been made to identify adequate start up monies for new faculty, and to provide supplemental monies in those areas in which such monies have traditionally been lacking. Most of these funds have come from sponsored research overhead, redistributed through the Research and Graduate Studies organization. It should be noted that these funds have been effectively used in support of research. Faculty recognize these efforts, but there is much more to be done. The University needs to work with state government leaders to establish a more direct state commitment to the research mission (e.g., the establishment of state support for graduate research assistantships, and increased funds for research, equipment, and maintenance).

2. Provide increased support to recruit and retain quality graduate students consistent with the University's role as the principal research and graduate education institution in the Commonwealth.

Since 1980, UK has improved its standing relative to its peers in the highly competitive arena of attracting and retaining top quality graduate students. However, much remains to be accomplished. Graduate student stipends have increased and are generally perceived as adequate and competitive. Continued recognition of the importance of adequately supporting graduate students is critical. Increased institutional commitment is needed to recruit and retain the best graduate students. Financial support for RAs should be equal to that for TAs, specifically including tuition remission. Additional RA positions are needed, and both TA as well as nonexternally supported RA positions should be funded from institutional funds.

3. Provide computer and statistical services consistent with the research needs of the University.

Since 1980 the University has eliminated recharges and adopted the "Fully Funded Open Access" computing model, which has significantly improved access to research computing. Concomitantly with the establishment of the Information Systems organization and the infusion of substantial new funds into computing, UK now is able to offer one of the premier research computing facilities in the United States today. In particular, large-scale scientific research computing needs have been addressed. Additional resources however still need to be focused on serving smaller-scale, (but no less important) research and instruction computing needs.

4. Ensure that budget constraints do not erode the quality of the library's resources and services.

The decade of the 80s was an especially difficult period for research libraries, as material costs escalated due to currency fluctuations and inflation, while university budgets failed to keep pace. As a result, a significant portion of the library's operating budget was not funded with recurring dollars. While this issue was well-recognized, scant progress was made in correcting this problem until the Information Systems reorganization was completed in 1988. By 1989, the library was moved organizationally into Information Systems. Since this reorganization, steady and regular efforts have been made to move the library budget to a full recurring general fund base. While a fully recurring-based budget is not yet in place, the progress is commended. The committee recommends that this commitment be continued and that the University recognize an obligation to maintain a competitive library budget on a recurring funds base.

5. Improve the communication systems and procedures employed in conducting University business.

SUMMARY AND CONCLUSIONS

Substantial progress is evident since 1980 in improving the process of conducting University business through the innovative use of technology and information systems. In the last 10 years new systems have been developed which have improved services in personnel, purchasing, accounting, and physical plant operations, to name just a few. New systems currently under development promise even more effective operations for the future. There still exist procedures and processes in various administrative departments which appear to hinder rather than promote

the conduct of research. In particular, faculty input to the establishment of operational procedures in these service units has been minimal. Increased dialogue among service managers and "end users" would significantly enhance the effectiveness of these services. Concerted efforts to remove unnecessary barriers to the conduct of research is needed.

Since the last Self-Study, the University of Kentucky has been designated a Research University I by the Carnegie Foundation. This national designation, coupled with the University of Kentucky's unique role in the Commonwealth, allows it to combine research, teaching, and service activities in ways that enhance the value of all of them. An impressive array of research accomplishments during the past decade demonstrates that the faculty, staff, and students of the University take their research obligations very seriously and have been successful in fulfilling them. Despite the progress of the past decade, continued improvement is needed in several areas. Major recommendations developed during our examination of research can be summarized as follows:

The University must recognize and provide direct support for research assistants as well as teaching assistants to reflect appropriately its broad mission. Furthermore, the University should redesignate all such assistants as "graduate assistants" and the tuition scholarship system should be extended to all supported graduate students. In addition, stipend levels need to be adjusted continuously to be competitive with benchmark institutions.

The University should be commended for its commitment to capital equipment acquisition in the form of the 1986 bond issue, and planning should be undertaken for another infusion of funds for research equipment within the next five years. The University must also expand its policy of providing maintenance support for the complex equipment needed to conduct competitive research. At the same time, more emphasis must be placed on the search for external funds for equipment.

Improvements are evident in the services/levels provided by the principal administrative support departments (e.g., purchasing, physical plant, controller, personnel). These service departments must recognize that their primary responsibility is to serve the user satisfactorily. Consequently, enhanced communication is needed between users, managers, and the personnel who directly provide the support service. These groups should meet regularly to identify and solve problems affecting the function of the research program.

Rules and procedures pertaining to research should be reviewed systematically and examined to ensure that they remain flexible and capable of changing as needs change. Careful judgement is needed at the most senior levels of administration to ensure that the ways the University chooses to conduct its internal affairs do not hinder academic research priorities.

The University should ensure that faculty and administrators have adequate input into the design of new space, that clearly-stated priorities be developed, and, most of all, that these priorities be preserved in actions on requests for space taken by Council on Higher Education (CHE) and state government. In addition, appropriate input from researchers should be sought regarding the allocation of existing space. The availability of space to support research activities is a general problem throughout the University.

The establishment of the position of Vice President for Research and Graduate Studies and the two Vice Chancellors for Research indicate clearly that the University is committed to conducting its affairs as a major research institution. However, the meshing of these

administrative positions, and the authority and responsibility assumed by each, needs to be monitored closely. Although emphasis should be placed on interdisciplinary and intersector cooperation, most importantly, the VP-RGS should continue to be a strong advocate for research throughout the institution, in both the traditional departments and in the research centers.

The decision to redistribute a portion of the overhead charges back to the faculty member(s) and the department has been an enormously powerful incentive to faculty. This policy should be continued, and the percentage distribution increased. Any change in this system for a given unit should involve prior discussions with faculty.

In order to retain quality support staff, flexibility in personnel policies is needed to allow essential staff members to be classified in the most financially rewarding category, so long as the category is appropriate to position and responsibility. A senior position in the personnel office with special responsibilities to support research needs should be considered.

The University must continually seek ways to encourage and foster cooperation and collaboration across departmental and college/sector boundaries; however, these collaborations are most effective when initiated by individual faculty. Policies, procedures, and incentive programs must remain sensitive to this need. The administration must be particularly vigilant to ensure that territorial prerogatives do not interfere with faculty initiatives.

The University should continue its emphasis on modern, high-powered computer facilities, with support services responsive to the varying needs of the University community. However, care must be taken to ensure that high-speed/large time block users are not catered to at the expense of others, who may have computing needs just as critical (if not as spectacular) and with equally sizeable commitments to externally funded research.

The University should continue efforts to expand library services and to move the entire library budget, including materials, to a full general funds base. As an essential academic and research support service, a stable funding base is critical to the continued growth and expansion of library services for the University and the Commonwealth.

Centers and institutes should continue to receive encouragement from the University to develop innovative multidisciplinary programs that will supplement the work done in departments without undermining departmental prerogatives.