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THE FUTURE OF THE RESEARCH UNIVERSITY*

by Richard C. Atkinson

Clark Kerr has identified 70 institutions in Western Civilization that have been in continuous existence since the Reformation. Two of these are the Roman Catholic Church and the Lutheran Church. Another two are the parliaments of Iceland and the Isle of Man. Remarkably, the remaining 66 are colleges and universities. What accounts for the ability of institutions of higher education to endure for such a long period of time? I believe the answer, which has considerable relevance for this symposium, is that they have remained true to the fundamental principles on which their existence is predicated and simultaneously have adapted to the changing world on which they depend for sustenance. Of course, no American college or university is old enough to be on Clark Kerr's list. But if the American research university is to thrive in the 21st century and beyond, it must emulate its European predecessors by adhering to essential principles and by evolving as the needs of society change.

ADHERING TO PRINCIPLES

Just what are the principles that should guide the actions of the university and those who work within it? Undoubtedly, a survey would reveal a strong consensus among us on this question. And I am sure that at or near the top of everyone's list would be the idea universities must be dedicated to the search for truth. It is this tenet, and its two subsidiary operating principles -- academic freedom and open inquiry -- that we need to focus on and remember as we contemplate the future of the research university.

Ultimately, it is their commitment to truth-seeking that earns research universities a special place in society. The view that we need organizations where talented individuals are given the freedom, security and support to pursue ideas to their logical conclusions is widely, although not universally, held. That the creation and dissemination of knowledge enhances the greater good is generally accepted, but the argument that research universities should be supported primarily to perform this function requires regular reiteration. How successfully this case can be made over the long term will depend on the degree to which we can honestly say that the university is indeed committed to the search for truth. If we come to be seen as just another special interest group or as organizations pursuing private gain at public expense, our privileged position will inevitably be jeopardized.

The key to legitimately protecting our image is the preservation of academic freedom and open inquiry within the university. Only if our faculty and students are at liberty to develop and communicate their own ideas and also have the opportunity to know about and challenge the ideas of others, will the university's contribution to the advancement of knowledge be sustained over the long term. Ironically, the protection of freedom and openness sometimes gets us into trouble with our patrons (parents, government, and industry). Universities that host controversial speakers, accept grants from foreign firms, or refuse to accept grants with unreasonable publication restrictions are inevitably subject to criticism. But we must either steadfastly resist

the temptation to compromise on principles that serve as the very foundation for our existence or be prepared eventually to pay a very dear price.

ADAPTING TO CHANGE

Adherence to essential principles is a necessary but not sufficient condition for the long-term viability of the research university. It is equally important that the university respond to the changing needs of society. Although most people will agree with this in the abstract, and although in certain specific instances it has obvious applicability, there are a number of contexts in which its application is not so clear.

Consider first the research university's teaching function. We are being challenged both from within and outside the university to answer the following questions: How many research Ph.D.'s should we be collectively producing? What should their distribution be across fields? What should be the division of responsibility between research universities and other institutions of higher education with respect to undergraduate education? How much should an education at a research university cost? (More on these last two questions later). Everyone within the university agrees these should be answered in ways that take account of the pragmatic needs of students and employers and the larger goals of society. But universities do not decide these matters unilaterally. The outcomes depend on the largely decentralized decisions of students, institutions of higher education, and state governments.

Basically, each institution is a competitive supplier that ignores market forces at its own peril. By and large, the system works pretty well. Occasionally, imbalances occur, but equilibrium tends to be restored fairly quickly. And the result is a quite defensible accommodation by research universities to the needs of the communities they serve.

When it comes to the university's research function, decision-making is more problematic because a greater number of decisions are made in the political arena, especially at the federal level. How should effort be divided between basic and applied research, or between strategic and curiosity driven research? To what extent should research be directed at national security, economic development, human health, or social problems? How should university-industry-government collaborations be organized and managed? Who should own the intellectual property rights to discoveries that flow from government-sponsored research? Because so much research, especially university research, is funded by the federal government, it is impossible to rely on a decentralized market mechanism to answer these questions. Inevitably, many of them will be answered centrally through the political system. How well suited is the research university to respond to the ever-changing demands placed on it by society whether those demands are expressed through decentralized markets or central political decisions? Although there do exist issues that we do need to address -- and, as is discussed later, some of these may require modest internal change -- I believe that the horizontal, non-hierarchical structure of the research university enhances its ability to adapt to a changing environment. Fortunately, it is that very same structure that tends to preserve both academic freedom and open inquiry. I am continually surprised that the same faculty that resist pressure from the public (or from an overly protective chancellor) to conform to some popular ideology can so readily adapt the curriculum to changing student interests or respond to new research funding opportunities. Central to the successful

functioning of the university under this structure is the independent faculty member operating within the virtually autonomous academic department. The latitude given to these academic entrepreneurs to teach their own courses and to carry out their own research programs, subject only to a rigorous, peer-review merit system, provides them with the freedom and incentives that make the system work.

WHAT HISTORY TELLS US

My optimism that the internal structure of the research university serves both to preserve its academic integrity and to promote its adaptation to a changing environment is borne out, I believe, by its relatively brief history. Although the origin of the American research university can be traced back to the establishment of Johns Hopkins University and the University of Chicago more than a century ago, it was not until World War II that what we think of as a modern research university began to emerge. Prior to then, the United States depended on Europe for basic research. We did attract a cadre of European émigrés (Albert Einstein, et al.) during the 1930s, but only when the importance of radar, electronic communications, cryptology and the atomic bomb became apparent was science recognized as critical to the national interest.

The recognition of the importance of science was crystallized in Roosevelt's letter to Vannevar Bush and Bush's subsequent report to Truman entitled *Science --The Endless Frontier*: There are three key ideas in this report that I believe remain valid to this day and that are directly relevant to the theme of this symposium. First, basic research should largely be funded by the federal government, because the payoff is too uncertain for any one company given that the results may not readily be appropriated by the organization undertaking the research. Second, basic research should be carried out in universities, not in government institutes or laboratories which inevitably would have too hierarchical a structure. And third, the allocation of funds for basic research should be made to individual investigators, not institutions, and based on peer review, not political considerations. We are all familiar with the events that followed: the establishment of NSF and NIH, the Cold War, Sputnik, and the substantial real growth, until just recently, of federal funding for research.

Few would disagree that the American research university responded to the challenge and served the nation well throughout the postwar era. The indicators all point in the same direction: the number of Nobel Prizes won by faculty members, the development of new industries in university communities, the attraction of U.S. Ph.D. programs to students from around the world. They all suggest that the rapid expansion of the American research university has been marked by unparalleled excellence, great achievement, and extraordinary contribution to the nation's well-being.

None of this should be taken to suggest that this rapid and successful expansion was without its stresses and strains. During this period, universities had to contend with efforts to impose secrecy on research related to national security, attacks on the patriotism of some faculty members during the McCarthy era, student protests and adverse public reaction during the Vietnam War, and substantial, periodic fluctuations in the Ph.D. job market. What I think is remarkable is that we were able to expand so dramatically and deal with these very serious challenges to the academic character of our institutions without seriously compromising our operating principles

of academic freedom and open inquiry. We were able to find ways to meet the shorter-term needs of the nation while at the same time preserving our academic integrity, which is so important to society's longer-term interests. This fact is what makes me hopeful about our ability to deal with the multiple challenges we face today without damaging the fabric of our institutions that has served us so well. I would like at this point to turn to several of these challenges.

DEFINING OUR UNDERGRADUATE TEACHING MISSION

Research universities have faced growing criticism about the quality and character of the undergraduate teaching they provide. We have all heard the complaints: faculty do not care about undergraduate teaching, and they do not do very much of it; our most prestigious faculty do not teach undergraduates at all; classes are too large and impersonal; and too much teaching is done by graduate student teaching assistants, many of whom can barely speak English. By and large, I believe these criticisms are unjustified. Our faculty do care about teaching, and they do a good job. At UC San Diego, according to the student-run course and teaching evaluations, 80% of both our courses and teachers earn a rating of "excellent" or "very good" from their undergraduate students. And our largest classes earn just about as high a rating as our smallest. My impression is that teaching evaluations at other research universities paint a similar picture.

Despite the general excellence of our undergraduate instruction, there is an element of truth to these complaints that stems from the economic constraints under which we operate. Compare, for example, UC San Diego with a typical selective liberal arts college. To begin with, UC San Diego has a student-faculty ratio about twice that of the liberal arts college. Taking into account that UC San Diego faculty members are expected to spend half their time doing research, we are left with a de facto undergraduate student-faculty ratio that is four times higher at UC San Diego. It is not surprising, therefore, that research universities have larger classes, and their faculty cannot develop close relationships with most of their students. Under the circumstances, however, I am impressed that undergraduate teaching at research universities is of such high quality. It should not be forgotten that research universities have certain natural advantages when it comes to teaching. Their faculty members are at the forefront of their discipline and can convey a special excitement about their subjects. Their undergraduates have extensive opportunities to enroll in individual or group study and work with faculty members on their research. At the same time, we need to be careful not to oversell our product.

The fact remains that students who do not show initiative or cannot work independently are likely to be better served by pursuing their education at colleges and universities that offer a more nurturing environment. A research university is simply not the best choice for every student. All types of colleges and universities have an important role to play in meeting the diverse educational needs of our rapidly growing college-going population. In this regard, the California Master Plan for Higher Education is noteworthy. The community colleges, the master's-granting public universities, and the University of California each have a well-defined mission. Under the plan, the University of California has a singular responsibility among public institutions for research and doctoral education. The master plan has served the state well for more than 30 years, and it deserves continued public support.

The American research university, unlike its counterparts in most other countries is expected to carry out all of those functions effectively, and it does. But we need continually to remind the public that undergraduate education is not our only mission and that it is very much in the nation's interest that what makes us unique and valuable, our research and doctoral education, must be preserved.

FACING UP TO THE RISING COST OF HIGHER EDUCATION

William Baumol has pointed out that the price of the product of a labor-intensive service industry like higher education can be expected to rise over time relative to the price of products in other industries. In order to attract its share of qualified employees, universities must offer competitive compensation (adjusting for differences in job security, psychic income, etc.). Because universities do not have the same prospects for productivity increases as other industries (such as manufacturing, agriculture, communications, etc.), their cost per student taught in real terms can be expected to grow indefinitely. As the result of this process, college and university tuition and fees and state government higher-education budgets have risen to the point where students, parents and legislators are beginning to object and resist.

The growing recognition of this problem in the context of a generally weaker economy over the past three years and a rapidly growing college-age population over the next decade has sent us scurrying for a solution. Logically, the only alternatives to continually rising costs of higher education are declining real incomes of university employees, rising student-faculty ratios with declining quality, rising student-faculty ratios without declining quality, and declining times to degree. Because the first two alternatives seem unacceptable and because we do not want them forced upon us, universities are vigorously searching for ways to achieve the latter two. Committees are in place exploring distance learning, interactive multimedia, and the three-year degree. Although the promise of a technological fix has been with us for some time without a genuine breakthrough occurring, I believe this is a road we must continue to follow. Real reductions in time to the Ph.D. are possible, but the prospects at the undergraduate level are slim, and in any event they can only be onetime solutions. As long as the possibility exists that we might be able to substitute technology for people without diminishing the quality of a degree, we need to continue to make the effort to find out how.

A somewhat different policy issue relating to cost that the nation must confront is whether we can afford to increase the number of research universities. Their enormous success has enhanced their prestige and thereby encouraged many comprehensive universities to seek to become research universities. At the same time, their valuable contributions to their regional economies have made state and local government officials eager to establish research universities within their jurisdictions, and many congressmen eager to provide support for them through earmarked appropriations. As the chancellor of one of the newest such institutions, it is a little awkward for me to raise this matter, but in a period of declining or at best stable resources, a proliferation of research universities would run the very real danger of spreading the limited available resources too thin. And if their number were to increase and their quality diminish, they not only would be less able to fulfill their mission effectively, they would also be less likely to be seen as special institutions worthy of special support.

STEMMING THE EROSION OF PUBLIC CONFIDENCE

Despite their success, research universities have had to deal with a series of problems that have become public relations disasters and have seriously damaged their credibility. Everyone is familiar with the trouble we have had with indirect costs, research misconduct, foreign support of university research, and use of human research subjects. There is no need to recount the details, and to do so would be too painful. Those of us who work within the university know that the extent of these problems has been exaggerated. Nevertheless, the problems are real, and they have exposed a need for improved management and oversight. We need to get our house in order. The question is how to do that without unduly restraining the individual scientists and scholars who are the keys to the research university's success.

Given the university's size and diffuse structure, it must operate on trust that administrators and faculty will behave ethically and responsibly. It is inevitable, especially under the competitive pressure under which most of us operate, that a small number will violate that trust. Even if we could afford to monitor everyone's behavior, the damage that would do to the university's free and open environment would be too high a price. We need to find less obtrusive ways to minimize the frequency of misconduct and to establish defensible ways to deal with such behavior when it is discovered. Fortunately, we have begun to do that with the establishment of more explicit guidelines that define unacceptable behavior and detailed procedures for holding people accountable for such behavior. Although that has required some prodding from Congress and funding agencies, I am pleased that we have made as much progress as we have.

EXPANDING RESEARCH RELATIONSHIPS WITH INDUSTRY

The end of the Cold War, growing concerns about the long-term vitality of the U.S. economy, erosion of the federal government's ability to fund research and development, and declining willingness of private industry to conduct its own R&D all have focused attention on the desirability of increasing university-industry collaborations. This has triggered expressions of concern from several quarters. Some in Washington argue that we are not doing an adequate job of transferring the technology that has been created from federal R&D funding. Some in industry believe that our patent and publication policies make us problematic partners. And some of our own faculty complain that we are too rigid and uncompromising in the way we conduct our affairs.

When considering what should be done about these concerns, it is important to remember that research universities have for many years played a major role in furthering the nation's economic development. Vannevar Bush's 1945 report cited economic development as one of the three justifications for federal funding of university research. And the record thus far has proved Bush to be right. An NSF study has analyzed the relationship between university research and new product development in various industries. It showed that the percentage of new products dependent on university research has been rather substantial, as follows: data processing, 30%; electronics, 11%; chemicals, 10%; instrumentation, 22%; pharmaceuticals, 46%; petroleum, 3%; and metals, 23%. A similar message is conveyed by the clusters of companies that have developed around major research universities. One only has to think of Silicon Valley (Stanford), Route 128 (Harvard and MIT), and the Research Triangle (Duke, UNC and NCSU) to be

reminded of the impact that university research has had. Some other less publicized but significant agglomerations have been developing throughout the country at places such as the Princeton Corridor (Princeton), Silicon Hills (Texas), the Medical Mile (Penn and Temple), Optics Valley (Arizona), and the Golden Triangle (UC San Diego).

Since the passage of the Bayh-Dole Act, universities have steadily been expanding technology transfer offices designed to patent and license to industry new technologies created by university research. A recent survey by the Association of University Technology Managers reveals that in 1992, 100 member institutions received 7,300 invention disclosures, filed 3,200 patent applications, had 1,500 patents issued to them, and negotiated 1,700 licenses. And they earned from previously negotiated licenses \$267 million in royalties. Clearly, technology transfer has become a well-established practice at research universities. Because it is still a relatively new phenomenon at most institutions, it is an evolving and rapidly growing practice.

Perhaps more important than the direct technology transfer that the above university-industry relationships point to is the indirect technology transfer that results from the employment by industry of university-trained M.S. and Ph.D. degree recipients. I have been struck by the number of industry supporters of the university who have said that they like our research, but what they really want from us is access to our students. In a survey of 56 firms in 1980 by the National Science Board, the two principal reasons cited for sponsoring research at universities were access to manpower (75%) and having a window on science and technology (52%). We should not forget when considering possible changes in the way we do business that our graduate education function is as important as our research function, and that the two are inextricably linked.

None of this is to say that we cannot or should not find ways to make it easier for industry to obtain access to university-developed technology or to accommodate industry sponsorship of university research. I believe we will. But we need to make changes carefully. I am particularly concerned that we not make changes that interfere with the freedom to publish research findings, create unmanageable conflicts of interest, or in other ways destroy the university's academic atmosphere or limit the free rein that faculty and students have to pursue what is of interest to them.

In fact, most research universities have made significant changes in policies and procedures in order to accommodate and facilitate university-industry interactions. For example, most accept a finite delay in publication of results from university-sponsored search in order to allow companies time to determine whether the proposed publication contains proprietary information or patentable discoveries, and when appropriate, to allow the university time to prepare and file patent applications. Most research universities have come to understand that university-industry relationships may create conflicts of interest, and have established mechanisms designed to manage most of them. Many universities have learned to live comfortably with new organizational forms as members of consortia or as hosts of industry-sponsored centers. As university-industry collaborations mature, newer forms of relationships are bound to emerge. I have no reason to believe that they cannot be designed to be beneficial to industry and at the same time consistent with the university's fundamental principles.

CONCLUSION

The views expressed above have a decidedly conservative ring to them. But universities as institutions, despite the creative and sometimes radical character of their faculty and students, are essentially conservative. And I believe this helps to explain their longevity. While they remain open to exploration and free expression of almost any idea, they adapt gradually to the world around them and, thereby, avoid bowing to the whims of fashion or buying into the latest ephemeral fad. This symposium could not have come at a better time. We are in the midst of an enormous sea change. But we need to move carefully lest we reinvent and create an institution that lacks the extraordinary qualities that have made the American research university the envy of the entire world.

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