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FEDERAL, STATE, AND LOCAL GOVERNMENTS: UNIVERSITY PATRONS, PARTNERS, OR PROTAGONISTS?

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ABSTRACT

Charles Vest gave the first of three Clark Kerr Lectures on the Role of Higher Education in Society on April 19, 2005 on the Berkeley campus. This essay argues that research-intensive public and private universities increasingly have far more similarities than differences in missions, structures, and even financial support. For both, the federal government, despite numerous tensions, remains our indispensable *partner*. At the same time, the role of state governments toward their public universities has evolved from that of *patron* to that of *partner* – sometimes a minor partner financially. Yet at every level – federal, state, and local – governments and universities each consider themselves to be the *protagonist* having the central role, moral authority, and last word in setting the objective and the course. Despite its complexities and tensions, out of this stew (with philanthropists and the private sector thrown in for good measure), we have forged the greatest system of higher education in the world and we must work hard and effectively to sustain and continuously improve it. We must strive for innovation and excellence, but also nurture broad access to this system and stay true to our fundamental mission of creating opportunity.

Perspectives and experiences change with time and over generations. In 1963, Kerr articulated the rapid metamorphosis of our research universities into something new and different. Campuses sprawled intellectually even as they sprawled physically across the landscape of state after state. As they evolved, they developed a complex web of purposes, and they created increasing tensions between societal utility and what had always been considered to be academic purity.

In the same year that Kerr articulated this, and much more, in the Godkin Lectures, I graduated from West Virginia University and headed to Ann Arbor to begin my graduate studies in mechanical engineering at the University of Michigan. What to Kerr, as a

leader of his generation, was a somewhat surprising new incarnation of the American research university, was for me a given. Michigan, MIT, Berkeley, Caltech, and Stanford were great magnetic attractors to a young engineering student who was truly a child of the Sputnik era.

The source of this exciting attractiveness was to a large extent what has been termed the “engineering science revolution.” This revolution was spawned primarily by faculty at MIT who, building on their experiences in the MIT Radiation Laboratory during World War II, created a radically different way of teaching and practicing engineering. The Rad Lab brought together a remarkable group of scientists and engineers to rapidly develop radar, whose key concepts and elements had been invented by the British, into a battle-hardened systems that many believe were at least as instrumental in the Allied victory as was the work at Los Alamos. A towering legacy of this work was a new world of engineering education built on a solid foundation of science rather than on macroscopic phenomenology, charts, handbooks, and codes. It was research intensive, required an entirely new panoply of textbooks and laboratories, and led and drove change in areas ranging from the space program to defense, transportation to telecommunications, and computing to medicine.

MIT (under engineering dean Gordon Brown) and Stanford (under provost Frederic Termen) were first movers, and Berkeley, Michigan, Illinois, and other institutions were fast followers and strong contributors. This corner of the emerging multiversity was very attractive and exciting. What a joy it was to pursue my engineering education in this heady environment, yet also to have as my personal friends medical, law, history, chemistry, mathematics, social-work, education, and philosophy students. How remarkable it was to be on a campus with endless opportunities to attend world-class musical events, to visit the art museum, and to attend lectures by the most influential scholars or practitioners from every discipline imaginable.

In short, I learned and worked at the new boundaries of academic engineering, and yet still felt very much a part of the great, centuries-old traditions and values of academia. These two aspects of the multiversity did not, and still do not, strike me as inconsistent. Rather the multiversity as I experienced it was a noble and enabling place. What appeared to many to be sources of tension, cross-purposes, and potential conflicts of values and interests were for me a great web or mosaic to be savored and celebrated. It was what I expected a university to be. And, despite the passage of forty years, it still is.

My Personal (University) Journey

When it was announced, in 1990, that I had been elected president of MIT, I received a letter from one of my Michigan colleagues, Paul McCracken, a distinguished economist and former chair of the Council of Economic Advisors. Here is the text of his letter in its entirety: *Dear Chuck, Boy from West Virginia becomes president of MIT. The American Dream. Sincerely, Paul.*

That brief note, in my view, encapsulates what is best about American higher education: we create opportunity. That is our mission. That is our business. That is first and foremost what society expects of us.

Great public universities like Berkeley and Michigan have a special role in that mission to create opportunity. It is captured in the epigram coined for the University of Michigan in the nineteenth century: *An uncommon education for the common man.*

Now, of course, we have arguments about for whom we create opportunity, and why, and how. But it remains the fundamental mission. Universities, especially research-intensive universities, also increasingly are viewed – by themselves and by others – as institutions that create opportunity for states, regions, nations, or industries by virtue of the economic impact of the knowledge and of the educated men and women they produce. This form of opportunity creation is driven largely by research activities. The nature of, and support for, this kind of opportunity creation are more complicated and less uniformly agreed upon than that of providing an uncommon education for the common person. But I, for one, believe it is an important and wonderful part of our mission as well.

My experiences as an undergraduate at West Virginia University; as a graduate student, professor, and administrator at the University of Michigan; as a visiting faculty member at Stanford; and as president of MIT have left me with a profound respect for American higher education and a deep appreciation for the opportunities I have received, helped to develop, and observed.

What Makes American Higher Education Great

We in the American academy sometimes get so wrapped up in our modest tribulations, and so upset by the discrepancies between our ideals and some realities, that we lose sight of how fundamentally good we are at what we do. The governments that support much of our work also appear to us to understand our importance less and less, and sometimes to criticize us more than support us.

Be that as it may, the rest of the world recognizes our essential greatness and the beauty and effectiveness of the opportunities and success we bring to our nation and world. In country after country they work diligently to learn our ways and means and to emulate them within their own contexts.

As is disclosed in study after study, ranking after ranking, and through that greatest of all compliments – emulation – we really are the proverbial envy of the world. This was driven home for me a few years ago when I conversed over dinner with the rector of Humboldt University. He looked at me and in all seriousness asked if I had any advice regarding how the U.S. research university model could be successfully transplanted to Germany.

The irony, of course, is that in the nineteenth century, the U.S. and, specifically, the Johns Hopkins University, imported the research university concept from Humboldt! This leads me to suggest some fundamental reasons why U.S. higher education continues to be excellent, effective, and well respected by our international peers:

- A broad diversity of institutions ranging from small liberal arts colleges to Ivy League schools and to the great land grant universities provides a wealth of environments and opportunities for students to select a school that best matches their needs and capabilities.

- New assistant professors have freedom to choose what they teach and the topics of research and scholarship they pursue. They are not subservient or apprenticed to senior professors, so they bring to our institutions a constant flow of new ideas, passions, and approaches.
- In our research universities, we meaningfully weave together teaching and research. This, too, brings freshness, intensity, and constant renewal.
- We welcome students, scholars, and faculty from other countries. They bring a defining quality of intellectual and cultural richness to our institutions.
- There is an implicit national science and technology policy that recognizes support of frontier research in our universities as an important responsibility of the federal government. This policy is intended to provide financial support to researchers based on their merit in a competitive marketplace of ideas. Funding for infrastructure is attached to grants and contracts and therefore flows to the researchers with the most meritorious ideas and track records.
- There is a tradition of individual philanthropy through which our alumni and others support our colleges and universities financially. Financial aid derived from their gifts enables talented students from families of modest means to attend even the most costly schools. Tax laws encourage such donations.
- There is open competition for faculty and students. Such inter-institutional competition, though it may be the bane of academic administrators' daily lives, drives excellence.

These factors are primarily structural, matters of public will, public policy, and indeed of public financial resources. Other nations could profitably consider these factors, integrating them into their own cultural and political context and perhaps improving upon them. Intelligence, curiosity, and creativity have no national boundaries. Great universities based on this residential, research-intensive model can and do arise anywhere in the world. As demonstrated by the enormous success and impact of the Indian Institutes of Technology, established in the 1960s, higher education can leap forward very rapidly.

Public/Private – Geographic Distribution

In order to keep myself refreshed, relevant, and experienced, I take advantage of one of the most cherished perquisites of an academic career – the sabbatical leave. Indeed, I go on sabbatical regularly – once every thirty years. During my last sabbatical in 1974, my wife and I packed up our young children and drove across the country from Ann Arbor to Palo Alto. It was a delightful journey, covering 4500 miles, although it would only have been about 2,000 miles as the crow flies.

One of the things I discovered is that the dominant shades of tan and grey of soil, rocks, and wood change as one moves west. More remarkably, the color of rabbits, chipmunks, prairie dogs, and other critters changes to match this shade as well. I assume they do this also in Kansas, where evolution may not apply, but I didn't test that empirically.

But on a journey from east to west, the framework for higher education also changes, not by adapting to the soil color, but as a result of the historically slow westward movement of the population and the consequent development of social and political structures.

In a nutshell, private colleges and universities, often founded with religious as well as secular objectives, dominate in the east. As one moves through the Midwest and the Great Plains, the land grant acts, the Northwest Ordinance, and the commonly shared needs of earlier agrarian societies have left a remarkable legacy of great state universities, but only a smattering of private institutions. By the time we reach California, we encounter perhaps our most refined system of state colleges and universities, as well as a modest but exquisite second growth of private universities.

Predictably, then, the relative role of the federal and state governments with our universities also shifts and changes across the land. But, it is my observation that this is less and less true as time goes on; i.e., there is a significant degree of convergence of structure, purpose, and funding of public and private institutions.

Public/Private – Financial Forces and Reactions

Having now served a private institution for fifteen years and also observed public universities, by looking back to Michigan and out at others, I can summarize their financial differences succinctly: When the economy is strong and growing, the grass is greener on the other side. When the economy is weak and declining, the grass is browner on the other side.

That is to say, public and private institutions are ultimately subjected to the same economic forces, but the publics seem to respond with greater volatility. One sits at MIT and usually sees a modest but steady year-to-year growth in faculty salaries. On the other hand, over the years, even the best public institutions may have zero raises one year, and double-digit increases a couple of years later.

And then there is the flip side, the differing nature of capital funding. Friends in the Michigan legislature could often find the money for buildings in years when salary budgets were hard to come by, largely because of the attendant construction jobs. At MIT, on the other hand, it was a hair-raising experience to orchestrate a major improvement of our campus between 1998 and 2005. We constructed about 25 percent of our current campus while the economy and equity markets skyrocketed upward at unprecedented rates and then decided that the laws of economics had not been repealed, and dove downward again. Add to that the fact that Boston-area construction costs also grew at historically unprecedented rates but did not drop when the economy went south, because the famous Big Dig was a huge federal project that was not subject to the laws of free-market economics.

You, too, would be ready for your once-every-thirty-years sabbatical!

Although these public-private differences have persisted for three or four decades, we are converging at a greater and greater rate. I think this is driven primarily by three factors. First, we are all dependent on the federal government as the lifeblood of our research and graduate education enterprises. Second, private giving and endowment

support increasingly provides the edge of excellence in state universities. Third, the roller coaster ride of the dot-com-era economy was so extreme that even the budgets of strong private universities whose names do not begin with H or P had to respond with uncharacteristic swings. Thus Caltech, MIT, and Stanford, during the last two years, all implemented operating-budget reductions and salary freezes of one form or another in order to position themselves back onto their traditional steady but moderate growth curves.

In 1969, two thirds of every dollar expended on the MIT campus through our operating budget came from the federal government, primarily from sponsored research. In 2004, only 36 percent of our campus operating budget came from sponsored research, of which about 60 percent was from the federal government. So, although our volume of federal research support continued to grow and remains indispensable, it has declined dramatically as a fraction of our operating expenses. Private support in the form of gifts, grants, and return on endowment grew from 20 percent to almost 40 percent to make up the difference. Of course tuition has grown, but we have worked very hard to restrain its rate of growth, and we must raise huge amounts of gifts and endowment to maintain the financial aid structure that makes MIT accessible to young men and women regardless of their financial status.

Because of the dominant and expensive role of science and engineering at MIT, we are perhaps at the extreme in the magnitude of these shifts (at least in non-medical fields), but the general description of a relative federal decline and a private increase in revenues to support our mission is still generic to private research universities. Stanford, for example, would present a similar profile. We have no state support to rely on – only tuition revenues, net of financial aid, and gifts and endowment income.

The story of Berkeley, or UCLA, or Michigan, or Illinois over forty years would be the inverse of this. On the time scale of decades, the fraction of federal research support in their operating budgets has grown dramatically, although over the last decade, outside of the biomedical fields, it has generally leveled out, even as various expenses have risen. State support has generally played the role for these public institutions that endowment has played for the privates. State support has provided infrastructure and has kept tuition and fees from growing as rapidly as they might have otherwise.

Despite the role of state support, private funding increasingly supports the margin of excellence, large fractions of capital construction, and other special operating expenses of public universities. In fact, in 2003-04, of the twenty largest university endowments, only five belonged to public universities,¹ but of the twenty largest annual fundraising totals, almost half belonged to public universities.² So, in time, the endowment gap between publics and privates will narrow. The large alumni donor bases of public universities will make this possible.

In the availability and role of federal research support and of private fund raising, the publics and privates look more and more alike, with some diffusion of the fiscal volatility that has characterized state universities occurring to some extent in the privates as well. But this view of convergence, while qualitatively correct, is deceptive.

The reason this convergence is deceptive is that the *scales* of public and private universities are very different. The largest endowment of a public university is the University of Texas System's \$10.2 billion, and the largest private university endowment

is Harvard's \$22 billion. But the University of Texas System has 160,000 students, while Harvard has 24,000 students. Thus the Texas System's endowment per student is \$64,000, while that of Harvard is almost \$1 million, about fourteen times that of Texas. Or to compare two other institutions of more typical scale, the University of Michigan, Ann Arbor's endowment per student is approximately \$115,000, while MIT's is \$570,000, about five times that of Michigan. For Berkeley or UCLA, this number is on the order of \$50,000 per student.

If our national economy grew steadily and strongly, and the federal commitment to research and advanced education grew as well, I think that the public and private institutions would continue to converge in their fiscal structure, although a healthy difference in scale and tuition levels could be maintained. But this is not the case.

First, over thirty years, the total federal support of university research in virtually all areas of physical and social science and of engineering have been essentially constant in purchasing power. But during this period, the number of public institutions capable of doing excellent research and advanced education has clearly grown in both the public and private domains.

Second, and far more important, a combination of decreased tax bases and social will has led to leveling and decline in absolute state support. The situation has varied in its severity from state to state, but the basic story is more or less the same everywhere.

The likely long-term consequence of these financial realities will be growing disparities between public and private universities in factors like faculty salaries combined with converging levels of tuition and fees.

F. King Alexander has recently studied the average difference of salaries of full professors at public and private Carnegie I research institutions, measured in constant dollars.³ In 1980, this difference was 2 percent. By 1990, this public-private salary disparity had grown to 20 percent, and after peaking at 27 percent in 1995, is about 25 percent today.

In 1980 the average difference in tuition between public (resident) and private Carnegie I research universities was 17 percent; in 1990 it was 15 percent; and it is about 20 percent today.⁴ Thus the percent change in average tuition has been approximately constant, while the average salary differential has grown substantially.

These overall average numbers do not present an entirely fair picture. For example, there are various differences in expectations, responsibilities, disciplinary distribution, infrastructure needs, and market forces among the professorates of these diverse universities. And, because of financial aid, the actual cost to many students and families, especially those in low-income brackets, of attending these public and private universities is not nearly as disparate as the tuition numbers alone imply. But all in all, the picture these financial facts paint is one about which to be very concerned.

The reaction of state universities to these fiscal realities during the next decade could well bring fundamental change to the landscape of America's higher education. One of the words most frequently spoken today by leaders of major public universities is *privatization*. Indeed for the last twenty or thirty years, public university leaders have frequently observed that only 10 (Michigan), 13 (Virginia), or 25 (Wisconsin) percent of

their total operating budget comes from state support.⁵ Public presidents and chancellors frequently, and rather accurately, point out that their institutions have moved from being *state supported* to *state assisted*, and now to being *located in the state*. This, coupled with a desire to maintain or establish absolute academic excellence, invariably leads to serious consideration of becoming private.

However, there are both pragmatic and policy considerations that should lead one to be cautious about this. Much of the revenue received by a university is not fungible. Federal or industrial support for research, for example, cannot be used for other purposes. Even very large fractions of private gifts and endowments are restricted to specific purposes. In the budget of a typical state university, the stream of funding that supports its most fundamental mission – undergraduate education – is predominantly from its state government.

When speaking of privatizing a university, one must immediately ask, “How much endowment would I need to replace my state support?” On average, one expends about 5 percent of the market value of an endowment each year, so the necessary incremental endowment would be approximately twenty times the annual state appropriation received by the university. For UCLA this would be about \$8 billion, for Berkeley this would be about \$10.2 billion, and for Michigan this would be about \$7.3 billion. These are very substantial amounts of money, and one must be realistic before leaping to the conclusion that a university should be privatized.

The issue of scale must also be addressed. Typical enrollments of the larger private universities, in round numbers, are 25,000 (Harvard), 19,000 (Stanford), and 23,000 (Penn). Among leading state universities, enrollments typically are about 50 percent larger, e.g., 33,000 (Berkeley), 38,000 (UCLA), 39,000 (Michigan), and 26,000 (North Carolina, Chapel Hill).⁶ I suspect that to a large extent the private enrollments are set points established by fundamental economic forces. Indeed, if one considers private colleges that do not engage substantially in sponsored research activities or have professional schools, enrollments are an order of magnitude smaller still.

One must be cautious when speaking seriously of privatizing large public universities. Caution, however, need not be an excuse for maintaining the status quo. The most likely outcome of all this is that the existing trends will continue, namely operating more or less privatized professional schools, or other specialized units, within public universities, while their core mission and much of their infrastructure remain largely state supported. But it is also not out of the question that a small handful of leading public universities might negotiate with their states for conditions under which they could truly privatize, with the state perhaps creating some of the necessary endowment in return for agreements, for example, about the number of state citizens who will be educated.

A good example is that the University of Virginia’s law and business schools are now becoming private, emulating to a degree the long-standing precedent of Cornell with its public and private components.

Beyond purely financial considerations of privatization of public universities, there is an even more important matter of policy – the nature of the social contract between the states and their universities. State universities were established above all else to create opportunity for their young citizens to advance themselves and to build the economies and general welfare of the states. They have served this purpose admirably over the

years. When contemplating changes such as privatization, universities and state governments must address fundamental questions: in the future, will we still offer an uncommon education for the common man and woman? Will our access to our campuses still be sufficient?

Over time, as the populations of many states have grown larger and larger, certain public universities became excellent institutions encompassing the broad ranges of research, scholarship, and professional education that enabled them to literally provide uncommon educations for common men and women. World-class excellence among such so-called flagship universities also has led to more cosmopolitan student bodies and greater catalytic roles in state economies. These institutions have become great sources of justifiable pride for their states. But it is a pride that often seems transient.

When I was growing up in West Virginia during the 1950s, that state funded the establishment of a new hospital for the university's medical school by levying a small, targeted tax on all soft drinks sold in the state. The population felt great pride of ownership and purpose of this university and medical school. In a similar vein, Americans of that era were very aware of the transformative nature of the GI Bill. Hopefully my nostalgia will be forgiven, but it would be wonderful if this widespread spirit of pride and purpose in public higher education could be regained today.

Public/Private – Excellence in What and for Whom

There has always been, and always will be, a tension between the federal and state governments that provide financial support for colleges and universities and the faculties and administrations of those institutions regarding the definition and role of excellence and access. To oversimplify the matter, governments tend to have a more utilitarian view of universities than do their faculties and administrations. Academic excellence as we understand it can be thought to be somewhat at odds with the certain populist philosophies that frequently dominate state legislatures and/or boards of regents.

Numbers of non-resident students, selection criteria for admission, tuition and fees, the allocation of financial aid, the balance of undergraduate education with graduate and professional training, and the overall size of student bodies are perennial matters of debate and tension among state governments, taxpayers, and university administrators, faculty, and students. Difficult as these matters are, they usually get resolved in due course through reasonably orderly political and administrative processes. But in our times, nothing has been so bitterly contested as the role of race, and diversity more broadly, in the admission of students. And these matters have not been resolved through orderly political and administrative processes. Rather, they have led to frequently acrimonious conflicts, and have followed multiple pathways, including public referenda and Supreme Court cases. They have torn at the heart and soul of our populations and institutions.

Arguments over diversity in public universities are laden with historical legacies, value systems, political ideologies, schemas for social good, legal technicalities, views of academic excellence, attempts to balance individual and societal benefits, and assumptions about evaluating quality. These arguments are all too often spiced with mean-spiritedness as well. But they are of central importance to the future of our states and nation.

I believe that the majority of those who engage in this debate share a common view of how the world should be – namely a world with a color-blind society that has institutions capable of evaluating each university applicant on an absolute, ordered scale of merit. The argument then should be a mutually respectful debate over how to reach that goal. But that is rarely the case.

One camp in the debate over diversity and affirmative action assumes that we have reached – or should pretend to have reached – a color-blind world, and that by lining up a few metrics like SAT scores and grades, we can fairly and objectively order the candidates and select the students to be admitted to the freshman classes of public institutions. The problem is that race still matters in America, and we are not capable of comparing each applicant to all the others on a simple but meaningful, quantitative, absolute basis.

My own view of these matters is that of an engineer who believes that problems should be directly addressed and effectively solved. They are the views of one who grew up in a border state between north and south, attended segregated public schools until ninth grade, and has spent a career as a student, teacher, and administrator in public and private universities. They are based on observation and experience, passionately held and legally supported by the U.S. Supreme Court in the *Bakke* and University of Michigan admissions cases.

Simply put, I believe that we as universities must preserve the legal right and moral authority to consider race as one of many factors in college and university admissions and in other programs and dimensions of life and learning on our campuses. Indeed this is essential to effectively pursue a goal that is stated in MIT's mission statement:

MIT is dedicated to providing its students with an education that combines rigorous academic study and the excitement of discovery with the support and intellectual stimulation of a diverse campus community.

To implement this, we first establish which of our 10,000 applicants cross a high bar of quality, based on measures such as grades, test scores, and class rank — regardless of their race or any other characteristics.

Then we make difficult, subjective choices from among those applicants who crossed the high bar by assessing as best we can the whole person. Race is one of many factors considered at this stage to build an understanding of who each person is and the context in which he or she has demonstrated accomplishment, creativity, and drive.

One of the consequences of this approach is that at MIT today our undergraduates are 42 percent women, 6 percent African-American, 11 percent Hispanic American, and 2 percent Native American — a student body that is remarkably diverse in so many other dimensions as well. I believe that this serves our nation's future well by providing opportunity to young men and women of remarkable academic talent and helping to build a future scientific and engineering workforce and leadership that reasonably reflects our population and its spectrum of cultures.

This is in stark contrast to my early years as an engineering educator. When I began my career as a Teaching Fellow and then as an assistant professor at the University of Michigan in the 1960s, it was extraordinary if I had more than one African American

student in my classes every couple of years. In fact, it was extraordinary if I had more than one or two women students in a class. And if I had either, they would almost certainly be one of the best three or four students in the class, because only through unusual drive and commitment would these students have come to study engineering.

The change from the 1960s to 2005 at MIT or Michigan is the result of institutional leadership and occasional courage. It is a result of the determination of innumerable families and communities. And I can only conclude that despite the length of the journey, our nation is a better place than it was three decades ago because of it.

It is for this reason that I am saddened and angered by the political actions here in the State of California that turned back the clock. This has been a state of great vision and action, having created the most remarkable system of public higher education in America. But today, as a direct result of Proposition 209, as well as past regental actions, the Berkeley freshman class has 3,600 students, only 108, or 3 percent, of which are known to be African Americans. Among these freshmen, my understanding is that the number of Black students intending to study engineering is zero.

I believe that this is a disservice to the future of this state and our nation, and that it in no way represents the result of rational meritocratic selection within a color-blind society. As a pluralistic society entering a technology-dominated, highly competitive, knowledge-based age, we will need to engage the talents of all of our people, and we will need a diverse high-end workforce and leadership.

In my view, at least for the moment, important instruments of state government and politics have collided head on with the purposes and means of your great universities with serious, negative consequences for our collective future. I deeply respect democracy, but I also believe that we have a responsibility to continue to make the case for race as one of many factors in university admissions, and work toward a day that people will return to the course from which they have dramatically veered.

The Endless Frontier – The Federal Government and Research

In November of 1944, as the end of World War II approached, President Roosevelt wrote to Vannevar Bush, who was serving as head of the Office of Scientific Research and Development (OSRD). Roosevelt noted that the successful conclusion of the war that he believed to be imminent owed much to the work of U.S. scientists and engineers. He asked Bush to establish a committee to tell him how the scientific community should be organized following the war so that it could have a positive impact on the nation's economy, health, security, and quality of life in peacetime analogous to that it had had on the war effort.

Bush organized a group of committees, and in eight months delivered to President Truman his seminal and now famous report, *Science the Endless Frontier*. The fact is that Truman did not accept this report. He turned instead to William T. Golden, a bright and influential New York attorney, to produce a new study. In so doing, Golden became in essence the first presidential science advisor, and the scientific community gained a lifelong friend, supporter, and advocate.

Nonetheless, the basic ideas that Bush set forth are the foundation of the most important partnership between the federal government and our universities. *Science, the Endless Frontier* also established the idea of the National Science Foundation.

By implementing the concepts of Vannevar Bush's report, the United States took a radically new approach to research and development and changed the landscape of our universities in fundamental ways. In most countries, the national infrastructure for research and development consists of public and private research laboratories that are largely disconnected from universities. The Bush report, however, proposed that U.S. public and private universities become the national R&D infrastructure. The idea was simple: the federal government would pay for the conduct of research in universities, and these research grants and contracts would enable and directly support the education of graduate students. Thus each federal dollar accomplished two objectives: generating new knowledge and technology, and simultaneously supporting the education of the next generation of scientists, engineers, and doctors.

Federal agencies, starting with the Office of Naval Research, began to implement this vision soon after the war, and in 1950, the National Science Foundation was established. Initially most funding came from the Department of Defense and the science and engineering faculties of a handful of universities like MIT and Stanford began to build major graduate programs. More and more agencies, like NIH, DOE, and later on NASA, established programs of university-based research, and the programs spread across our public and private universities and grew larger. Major growth spurts followed externalities such as the security needs of the Cold War, our response to the Soviet launch of Sputnik, and the revolution in biomedical science.

This federal-university partnership has transformed our universities, been remarkably productive, and made us the unquestioned world leader in research-intensive education. In the pure and elegant form of this partnership, faculty members or groups submit to federal agencies proposals to support research they believe is important. On some annual cycle these proposals are reviewed by panels of experts and, with their advice, the agency selects the most intellectually meritorious ones for funding. Because research programs also require buildings, light, travel, equipment, employee benefits, etc., the sponsoring agency supports a fair share of such *indirect costs* of research to each grant or contract.

By this ideal process, federal funds are committed through a free marketplace of ideas to support the best research done by the most talented researchers, who in turn attract the best students. Indirect costs flow together with the research and, over time, a large number of excellent research-intensive universities have blossomed, and huge numbers of bright young men and women have been educated and trained.

This is the golden ideal of the federal government and universities as partners. It has been enormously effective and productive.

But real things do not long inhabit ideal systems. As the size and scope of the federal-university partnership grew, so did its complexity, bureaucracy, and fiscal and political stresses. The sources of stress are well known. First and foremost, the pool of federal dollars is never sufficient to fund all the good ideas; the number of universities capable of doing very good research and advanced education has outstripped the available federal funds. Additionally, politicians are concerned that funding is not distributed

appropriately across our geography. Some fields are well supported while others are not. Many in Congress circumvent the process of merit review and simply earmark money in bills to flow to institutions or programs in their districts. The arguments about what is the federal government's *fair share* of indirect costs and about the accounting requirements spelled out in OMB Circular A-21 are as endless as the scientific frontier envisioned by Vannevar Bush.

When our economy is threatened, as it was by the Japanese manufacturing revolution in the 1980s, many want to ignore fundamental research and emphasize rapidly commercializable R&D. Some believe it is bad when large revenues flow to universities and professors based on intellectual property generated by federally sponsored research (a rare event). Agencies frequently require that institutions or companies share the costs of supporting research projects. Regulatory burdens, reporting requirements, and the number and complexity of proposals that busy faculty must write seems to expand continually.

Acceptance of federal funds becomes a legal hook for the government to impose campus policies to eliminate affirmative action, establish gender equity in athletics, or to insist on acceptance of military recruiters on campus. National security concerns lead to arguments about what research topics should be classified and whether they should be conducted on university campuses. And since the horrific attacks on our nation on September 11, 2001, issues regarding visas for international students and scholars, their access to certain knowledge and technologies in the conduct of research and education, the control of dangerous biological agents, and the openness of scientific inquiry and communication have all become contentious issues.

So as wondrous as is the federal-university partnership, it is also a source of ongoing tensions. These matters range from mere annoyances and political inevitabilities to sources of the deepest concern. But we must respect, nurture, and forever renew and improve this partnership.

For too long, we in universities have tended to treat our federal funding as a birthright. It is not. Leaders in Washington have very difficult jobs, and beneath the political veneer that sometimes confounds or exasperates us, it is my experience and observation that they work very hard to do what they believe is right for the country. It is our duty as faculty, students, and administrators to devote serious time and effort to better informing the public and our elected officials what we in universities do, why we do it, how we do it, and why it is crucially important to the future of the nation and world.

States, Universities, and Economic Development

During the last twenty-five years or so, there has been a dramatic increase in state government involvement with universities, largely through R&D support, aimed at enhancing the economy of the state. There is a long history of land grant institutions supporting local economies through the Agriculture Extension Service. These federally funded entities provide support for agricultural research, but are even better known for their agricultural extension agents who provide practical advice to farmers, based on contemporary agricultural science and practice. For generations these agencies were valued greatly by small farm owners, but they also played a significant role in the effectiveness of schools of agricultural and agricultural engineering.

There is a parallel history of entities like Engineering Experiment Stations and connections of state universities to state highway departments.

The new interactions of states with universities, however, are largely aimed at the role of modern technology in the economic development of the state. Anecdotally, there would seem to be two strong waves of such state investment and engagement. The first, starting in the late 1970s and early 1980s, was aimed at improving manufacturing capabilities, thereby stimulating job growth. The motivation came when U.S. manufacturing industries found themselves to be increasingly non-competitive in world markets as Japanese companies, especially in the automotive and consumer electronics sectors, attained levels of quality, throughput, and efficiency that far exceeded ours.

The second, and more pervasive, wave came about as states began to recognize that small companies and entrepreneurial activities had led to stunning success and job growth in some regions. It was also clear that the presence of world-class research universities was an important stimulus and participant in these economic successes. The primary models were Silicon Valley in California and the Route 128 corridor around Boston.

Actually, Silicon Valley and Route 128 were creations of the private sector, supported by venture capital, and not driven directly by government planning or support. They were clusters of innovation driven by a dynamic that involved both competition and cooperation among technology companies founded and supported by bright, well-educated people. However, the presence of federal laboratories, high-level defense companies, and especially universities—whose cutting-edge research programs and education in engineering and science were all largely supported by the federal government—were essential to the phenomenon.

Route 128 had strong precursor activities starting in the 1930s, and Silicon Valley had its origins in activities in the 1950s. They were not sudden, strategically planned developments. But in the last twenty-five years, state after state, worried about their stagnating industries and exported jobs, has undertaken explicit economic development activities, frequently involving partnerships with their universities. The goal has been to revitalize old industries, jump start new ones, and/or attract companies headquartered elsewhere to establish factories or R&D facilities in their state.

By 1995, the fifty states collectively were investing almost \$2.5 billion per year in R&D activities performed by universities and/or industry.⁷ Almost 75 percent of this work was performed by universities. State investments have included the establishment of centers of excellence in specific fields believed to have likely economic benefit in the not-too-distant future and also activities aimed at more effectively spinning out new companies based on intellectual property developed at the universities.

I strongly believe that the role of modern research universities in economic development is critically important. I also believe that farsighted investment by states to establish research excellence and to encourage university interaction with the private sector is wise, and that state support should constitute a larger portion of the national investment in university research. But having stated this, there are several realities and pitfalls of which state government and university leaders must be cognizant.

First, these are strategic, not tactical moves. The largest return on these investments is in attracting and retaining bright, innovative people to the region and enhancing the R&D infrastructure available to them. The forces of competition, cooperation, and serendipity usually outstrip our ability to plan and predict in detail. The largest payoffs are long-term. As in the private sector, multiple seeds must be sown, and there must be a tolerance for failure. This tolerance, by the way, is one of the great differentiators between the U.S. and most other nations.

Second, every state, town, and city cannot become the New Biotech Silicon Valley. There will only be a few, and this industry does not lead to large employment. Clusters of economic development need to be based on realistic assessments and development of talent, infrastructure, and local characteristics. San Diego's emergence as a world leader in digital communications is a great case in point. Twenty-five years ago, they didn't try to out-perform Silicon Valley in computing, they set out on another exciting and productive path. By the way, it doesn't always have to be about the "new new thing." It can also be about doing old things in new ways. I suspect that much of the payoff in nanotechnology will be of this nature – making everyday products with desirable new properties and characteristics.

Third, states must be careful about their assumptions regarding leveraging their funds with federal funds. Of course, a wonderful outcome of state investment in university R&D, people, and infrastructure is to slide activities ultimately onto federal support with a huge multiplier. But competition for federal funds is – and should be – strong. Every state initiative cannot expect to be leveraged and sustained in the long run by huge federal funding. It would be especially unfortunate if the desire to leverage in this manner simply leads to increased earmarking and pork-barrel politics, thereby defeating the system of merit-based competition in a free marketplace of ideas that has made our national innovation system so effective.

Fourth, university technology transfer activities should be energetic, but kept in perspective. Technology transfer activities should have as their primary goal moving university knowledge and innovations into the private sector. It helps to recognize that the university patents that have paid enormous royalties can be counted on the fingers of one or two hands. At MIT we are proud of the income from royalties and income at IPOs from small percentages of founders' stock. But, as president, I always insisted that we not build models of such income into our budgets in a way that made us dependent upon them, thereby running a risk of distorting our basic mission or bringing improper pressure on faculty members. We absolutely must maintain firm but fair policies on conflicts of interest and conflicts of commitment.

Local Governments – Pilot, Programs, and Politics

I once sat in a meeting listening to an excellent talk by the president of the University of Pennsylvania about the investments they were making in improving the quality of life in a long-decaying area of the city adjacent to their campus. Her leadership and perspective were interesting and meritorious. But the chancellor of an unnamed West Coast university leaned over and with good humor whispered in my ear, "Just what am I supposed to learn from this? Our campus is surrounded by Hollywood, Westwood, and Brentwood!"

Therein lies a serious point. The community context of our campuses matters. I daresay the most complex politics most of us face are local. When, as president of MIT, I had to venture into meetings with officials of the City of Cambridge, I carried with me a facsimile of the letter the City Council wrote to MIT in 1916 *inviting* us to move from Boston to Cambridge. I also frequently reflected on the fact that when I came from Ann Arbor to MIT in 1990, a small reception was held to introduce me to Cambridge officials. A former mayor of the city vigorously shook my hand and said, “You must be a good guy – you are from one of only two other cities that are nuclear-free zones!” (This audience will know what the other one is.)

And there was the time that our athletic director was getting a haircut and started conversing with a young man who mentioned that he was in a soccer league whose games were played on our athletic field. This was news to the director – a sort of exercise in reverse eminent domain.

Many citizens are simply antagonistic toward large institutions, and their political agendas are, to use a well-worn phrase, up close and personal. As a consequence, the jobs of university government- and community-relations officers are second in difficulty only to those of admissions and financial aid officers.

Every university has the dilemma of wanting to be a good citizen of its town or city, while knowing that its perceived deep pockets are filled with money intended for students, faculty, education, research, and campus facilities – not for other discretionary purposes. Discussions of Payments in Lieu of Taxes (PILOT) are among the most difficult in which we engage. The city government often views us as their patron, and our trustees shudder to see money flowing to host cities when it is not absolutely required by law. (It is perhaps symbolic that my very last act at 5:00 pm on my last day as a university president was to join the Cambridge city manager to sign a PILOT agreement.)

I must say, however, that despite these inevitable tensions and frequently orthogonal views of our roles and responsibilities, some of my greatest satisfactions came from service-oriented programs that engaged our students, staff, and faculty as partners with other citizens of our surrounding community. Students’ experiences through such activities were sometimes life-changing. When I asked graduating seniors what they deeply valued in their years at MIT, the most frequent answer may well have been “tutoring kids in the Cambridge schools.”

Conclusion

Our research-intensive public and private universities increasingly have far more similarities than differences in mission, structure, and even financial support. Our federal government, despite numerous tensions, remains our indispensable *partner*. The role of state governments toward their public universities has evolved from that of *patron* to that of *partner* – sometimes a minor partner financially. Yet at every level – federal, state, and local – governments and universities each consider themselves to be the *protagonist* having the central role, moral authority, and last word in setting the objective and the course.

Despite its complexities and tensions, out of this stew (with philanthropists and the private sector thrown in for good measure), we have forged the greatest system of higher education in the world and we must work hard and effectively to sustain and

continuously improve it. We must strive for innovation and excellence, but also nurture broad access to this system and stay true to our fundamental mission of creating opportunity.

Notes

¹ "741 College and University Endowments, 2003-4," Facts & Figures, *The Chronicle of Higher Education* (2005), <<http://chronicle.com/stats/endowments/>>.

² "Top Fund Raisers, 2003-4," 2005-6 Almanac, *The Chronicle of Higher Education* 52, issue 1 (2006), 28.

³ F. King Alexander, "Chronicle analysis of American Association of University Presidents salary data," as reported in Scott Smallwood, "The Price Professors Pay for Teaching at Public Universities," *The Chronicle of Higher Education*, 20 April 2001, <<http://chronicle.com/weekly/v47/i32/32a01801.htm>>.

⁴ John Vaughn, 20 April 2005, personal communication (with data from AAU Data exchange).

⁵ "More state universities seek 'privatizing' route," *Chicago Sun-Times*, 4 May 2004.

⁶ "Campuses With the Largest Enrollments, Fall 2002," 2005-6 Almanac, *The Chronicle of Higher Education* 52, issue 1 (2006), 14.

⁷ John E. Jankowski, "What is the State Government Role in the R&D Enterprise?," National Science Foundation, Division of Science Resources Studies, NSF 99-348 (Arlington, Virginia, May 1999), <<http://www.nsf.gov/statistics/nsf99348/pdf/nsf99348.pdf>>.