

Some Observations Concerning
the Future of the Public Research University

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It was quite an honor to have been paired to discuss the future of public and private research university with Don Kennedy, President Emeritus of Stanford University and one of the leading university presidents of recent years. But, now that I am seated here next to Don, I worry that there may be been another agenda: to demonstrate the extraordinary impact of that great personal transformation that occurs when one steps down from the presidency of a major research university. Here I am--before--looking pale, haggard, short of temper, and even shorter of any sense of humor. And, beside me, Don, looking tan, well-rested, energetic, and happy!

Needless, to say, I'm looking forward to my release from the prison of the presidency on July 1!

When I asked Marta Cehelsky what Frank Rhodes wanted in these brief talks, she stressed the desire to be provocative. Not much of a challenge for a lame duck, since most of my quacking these past few months has been designed to provoke.

There is really no need to make the case for the importance and impact of the public research university. Our site for this meeting makes that abundantly clear. Here, on a campus of one of our nation's most treasured assets, the University of California, we are surrounded by ample evidence of the impact of the public research university.

To make this even more apparent, consider ranking of the top research universities in America, as measured by level of their research expenditures:

<u>University</u>	<u>FY 94 Research Expenditures</u>
U. of Michigan	\$431 M
U. of Wisconsin	392
MIT	364
Texas A&M	356
U. of Washington	344
U. of California, San Diego	332
Stanford	319
U. of Minnesota	318
Cornell	313
U. of California, San Francisco	312

Note that five of the top five institutions in research expenditures are public (...in fact, some would maintain that all five are public, since most of MIT's funding comes from public sources--i.e., the federal government--and it also happens to be the land-grant university for the state of Massachusetts!) Further, 15 of the top 20 institutions are public universities. This ranking is indicative of the fact that public universities conduct most of the nation's academic research, produce most of its scientists and engineers, and educate most of its students.

But this should not be surprising. After all, the fundamental characteristic of the public university is the strong bond between these institutions and the society that created them. Historically these universities have been shaped by, drawn the agendas from, and been responsive and responsible to the societies that founded them.

We generally think of the public university arising from the sequence of land grant acts, the Morrill Act of 1862 giving states federal lands to establish universities, the Hatch of 1877 creating the Agricultural Experiment Station, and the Smith-Lever Act of 1914 establishing the Cooperative Extension Service. But, in reality, these institutions trace their history back many decades earlier, to those founding words of the Northwest Ordinance: "Religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged." In prairie communities such as Madison, Champaign, and Ann Arbor, extraordinary universities were built that would become the paradigm of higher education in 20th Century America.

During the past century, our public universities created and applied knowledge while providing the human resources needed to address critical national problems. Through oncampus scholarship and offcampus extension activities, these institutions were key players in the agricultural development of America and then in the transition to an industrial society. World War II provided the impetus for even greater service as the universities became important partners in the war effort. It was natural that these institutions would adapt easily to the paradigm of the modern research university, as set out in Vannevar Bush's report, *Science, the Endless Frontier*, as it echoed the Northwest Ordinance by proclaiming: "Since health, well-being, and security are proper concerns of government, scientific progress is, and must be, of vital interest to government."

Today these institutions play an absolutely critical role in our lives. Yet, in a world driven increasingly by knowledge, by educated people and their ideas, they are destined to play an even more significant role in our future. As Erich

Bloch, former Director of the National Science Foundation, stated it in Congressional testimony:

“The solution of virtually all the problems with which government is concerned: health, education, environment, energy, urban development, international relationships, space, economic competitiveness, and defense and national security, all depend on creating new knowledge--and hence upon the health of America’s research universities.”

What is a Public University?

Perhaps, before we get too far ahead of ourselves, it is useful to define “public” universities. While one might be tempted to use funding source as one possible distinction between public and private universities, the tables below comparing relative funding indicate that both types of institutions receive substantial public support--even more so, when tax benefits are taken into account.

Current Fund Revenues (FY94)

	<u>Private</u>	<u>Public</u>	<u>UM</u>
Tuition	41%	18%	17%
State	2%	37%	14%
Federal	15%	11%	14%
Gifts & Endow	13%	5%	6%
Other E&G	5%	6%	3%
Medical	10%	11%	40%
Other Aux	13%	12%	6%

Education and General Revenues (FY94)

	<u>Private</u>	<u>Public</u>	<u>UM</u>
Tuition	54%	24%	32%
State	3%	48%	26%
Federal	19%	14%	26%
Gifts & Endow	17%	6%	11%
Other E&G	7%	8%	6%

Of course, public universities do receive substantial support through direct appropriations from state government, which tends to subsidize their very low tuition levels compared to private institutions. But even this is changing, as the table below suggests:

Education and General Budgets (FY94)

	<u>Harvard</u>	<u>Michigan</u>
Tuition	\$368 M	\$351 M
State	0	261
Federal	\$234	311
Gifts	176	140
Endowment Payout	283	75
Other E&G	139	234
Total	\$1,238 M	\$1,372 M

Note the income from tuition, federal support, gifts, and other activities are quite comparable for both institutions. The principal difference between the two is that the support provided by Harvard's very large endowment is matched by Michigan's state support. In fact, one might even regard the Michigan's state appropriation as the equivalent of the payout on a \$6 billion endowment--controlled by the state, of course. There is one additional comparison. Harvard's enrollment is roughly half that of Michigan's. Hence, while the Education and General budgets are roughly the same, the expenditures per student for a private institution like Harvard are roughly twice that for a public institution such as Michigan.

One might also consider the degree of public responsibility and accountability to distinguish between public and private institutions. Yet, here too, there is more similarity than difference, since both types of institutions have accepted a significant social contract through public service and serving broad and diverse constituencies.

Perhaps the best characteristic to distinguish between public and private institutions involves their governance. Public universities are clearly owned and governed by states and are held accountable to a myriad of state regulation and laws. This is reflected in the rules and regulations governing their operations such as sunshine laws. It is also manifested in the nature of their governing boards, which are generally political in nature, frequently selected through a

partisan political mechanisms--whether appointed or elected--and viewed as representing the public's (i.e., taxpayer's) interest rather than serving as trustees for the institution. Indeed, this contrast between the "trustee" philosophy of the governing boards of private universities and the "watchdog" stance assumed by public governing boards is one of the most significant differences today.

The Challenges of Today

While public universities share most of the challenges faced by private institutions, there are some that are unique to their public character. Let me share with you several observations, drawn from my own experience in leading a major public research university over the past decade.

The Political-Economic Crisis

All universities are suffering the consequences of the structural flaws of national and state economies, the growing imbalance between revenues and expenditures, that are undermining support for essential institutions as governments struggle to meet short-term demands at the expense of long-term needs. The new mantra of the day in Washington has become "Balance the budget within seven years". While the particular Tao, the path to deliverance, is still uncertain...whether via the Contract with America or Reinventing Government...the endpoint is clear. Discretionary domestic spending, research and education programs, and federal support of the research university, all are at great risk. Some leaders have even suggested that the very viability of the research university paradigm may be at significant risk during the next several years.

The states are also in serious trouble. Cost shifting from the federal government through unfunded mandates such as Medicare, Medicaid, ADA, and OSHA has destabilized many state budgets. The commitment many states have made to funding K-12 education through ear-marks off-the-top and massive investments in corrections have undermined their capacity to support higher education. In fact, in many states today, the appropriations for prisons has now surpassed the funding for higher education and shows no signs of slowing. A case in point: a decade ago, when I began my presidency, Michigan had 15 public universities and 8 prisons. Today we still have 15 universities, but 35 prisons. More to the point, this year our state will spend \$1.4 B for the education of 250,000 students in its public universities and over \$1.4 B for the incarceration of 40,000 inmates--at an annual cost per inmate of \$35,000, somewhat more than the cost of a Harvard

education! This situation is not unique to Michigan. California is in a similar bind, destined to worsen with mandatory sentencing--"Three strikes and you're out".

In my view, these structural budget problems will make it very difficult for most states to provide better than inflationary increases in appropriations for higher education in the decade ahead--and for many even this scenario will be overly optimistic. Although some have suggested that the states might be willing to pick up some of the shortfall resulting from declining federal support for university-based R&D, I believe it is quite unrealistic to believe that most states will have either the capacity or will to do so.

The One-Percent Problem

There is an additional challenge faced by the best of America's universities. Harold Shapiro, President of Princeton University, identifies what he calls the "one-percent problem" facing those institutions that compete to be the very best in teaching and scholarship. The decade of the 1980s experienced a trend in which the costs of achieving excellence in higher education rose roughly one percent per year more rapidly than the available resource base. Most studies project that this trend is likely to continue throughout the 1990s, driven in part by the expanding knowledge base and by the cost structures of quality research and teaching. While a given institution may be able to accommodate such an imbalance between costs and revenues over a short period, it is clear that over the long term, the "one-percent problem" will require a significant restructuring of the mission and activities of the university.

Cost Shifting

There is another dilemma here, one perhaps best illustrated by the old parable of the blind men each feeling different parts of an elephant and arguing over just what the whole beast looks like. The modern research university is complex and multidimensional. People perceive it in vastly different ways, depending on their vantage point, their needs, and their expectations. Students and parents want high-quality, but low-cost, education. Business and industry seek high-quality products: graduates, research, and services. Patients of our hospitals seek high-quality and compassionate care. Federal, state, and local governments have complex and varied demands that both sustain and constrain us. And the public itself sometimes seems to have a love-hate relationship with higher education. They take pride in our quality, revel in our athletic accomplishments,

but they also harbor deep suspicions about our costs, our integrity, and even our intellectual aspirations and commitments.

Beyond the classic triad of teaching, research, and service, society has assigned to the University over the past several decades an array of other roles:

- improving health care
- national security
- social mobility
- parenting
- big-time show biz (intercollegiate athletics)

Today society is asking to us to assume additional roles such as:

- revitalizing K-12 education
- improving race relations in America
- rebuilding our cities
- securing economic competitiveness

Looking at the university from an economist's perspective, one would see as inputs our people--students, faculty, and staff--and our funding--tuition paid by students and families, gifts and income on endowments, and taxpayer dollars from state and federal governments. Our outputs are the value-added through the education of our students, the knowledge produced on our campuses, and through direct services to our society such as through agricultural extension services or teaching hospitals.

The problem is simple: Each stakeholder wants to minimize the input it provides and maximize the output it obtains from universities, but none of the funding contributors is looking at the university as a whole, with diverse missions. More specifically, each party seems to want much more out than it is willing to put in, thereby leveraging other contributors.

Unfortunately, most people--and most components of state and federal government--can picture the university "elephant" only in terms of the part they can feel, e.g., research procurement, student financial aid, and political correctness. Few seem to see, understand, or appreciate the entirety of the university. This is particularly true in Washington, where each element of the federal government attempts to optimize the procurement of the particular products or services they seek from our research universities. There seems to be

little recognition that shifting federal priorities, policies, or support aimed at one objective will inevitably have an impact on other roles of our institutions.

Let me illustrate this with two recent examples: Federal efforts to impose artificial limits on the reimbursement of indirect costs on research grants, and the alarming trend to increasing cost-sharing requirements.

Recent efforts to reduce the costs of federally-sponsored research by imposing limits on the rates in indirect cost reimbursement is an example of the type of cost-shifting. While complex to calculate, indirect costs are nevertheless real costs associated with the conduct of federally-sponsored research, and must be paid by someone. Indeed, many of these costs are driven directly by the federal government through layer after layer of regulation, accounting, audits, and policy shifts.

To put it in the bluntest of terms, most institutions have only one recourse to respond to federal efforts to pay less than the full costs of the university research they procure: student tuition and fees. That is, if the federal government decides it wants to reduce federal research expenditures by several hundred million dollars by capping indirect costs, in reality it is asking students and parents to pick up this much of the tab for federal research projects, since this is the only alternative funding source most universities have.

The same can be said for cost-sharing requirements on federal grants. While there is a certain simplistic rationale behind such requirements--after all, cost-sharing can be viewed a kind of earnest money proving the sincerity of the institution seeking the grant--they can have serious negative implications, since they usually result in the diversion of discretionary funds away from educational programs and into federally-sponsored projects.

Politics

Most of America's colleges and universities have more than once suffered the consequences of ill thought out efforts by politicians to influence everything from what subjects can be taught, who is fit to teach, who should be allowed to study. Too often such interference is a short-sighted effort to exploit public fears and passions of the moment for immediate political gain. The long term costs to citizens is high because politically motivated intrusions into academic policy lead in the long run to educational mediocrity.

Once again harmful political forces are gathering strength to intervene in university affairs. This time they originate in California, where the Governor and his appointed regents have ordered the University of California to dismantle its time tested and effective affirmative action policies by next year. A ballot initiative eliminating government affirmative action programs entirely is slated for a vote in November. Inspired by California's example, more than a dozen states are now reported by the Washington Post to be considering similar legislative initiatives to end affirmative action in admissions, hiring and financial aid decisions.

This intensifying political pressure on our nation's great public universities is a threat to their unique historic role of providing a world class educational opportunity to all students who have the will and ability to succeed. And if politics today influence university admissions policies, what will be targeted next? Curriculum? Faculty Hiring? Research?

Further, the special interest politics characterizing our times, with their slash and burn tactics, sometimes focus on higher education. In the past, these institutions so critical to our future were buffered from such attack politics both by their governing boards and the media. Today, however, these groups now serve to focus and magnify political attacks on our campuses rather than shielding us from them...

Sunshine Laws

Public universities face one particular political challenge spared private institutions, sunshine laws. Most states have passed laws requiring that the meetings of public bodies such as governing boards be open to the press and members of the public. Further, many also have freedom of information laws that require public disclosure of any documents or data not protected by personal privacy laws. The media is using these laws not simply to pry into the operations of public institutions, but actually to manipulate and control them.

Populism

Higher education is also no stranger to the forces of populism that rise from time to time to challenge many other aspects of our society--a widespread distrust of expertise, excellence, and privilege. Indeed, many universities, faculty, university administrators have made themselves easy targets by their arrogance and elitism. But today we see a particularly virulent form of populism, almost a post-modern, deconstructionist variety, that aims at not simply challenging but actually

destroying our social institutions and commitments. This slash and burn approach offers little in the way of alternatives. It also has a decidedly anti-intellectual character.

The Biggest Challenge of All: Change

Let me suggest that beyond the financial pressures, the cost-shifting trends, politics, and populism, there is yet another important theme that we must consider, and that is change itself. Today we find ourselves in the midst of two simultaneous paradigm shifts: i) in the nature of the government-university research partnership and ii) in the character of the university itself. These shifts are being driven by the extraordinary nature and pace of change in the world today.

Let me consider each, in turn.

A Shift in National Priorities: From Guns to Butter...

For almost half a century, the driving force behind many of the major investments in our national infrastructure has been the concern for national security in the era of the Cold War. The evolution of the research university, the national laboratories, the interstate highway system, our telecommunications systems and airports, the space program, all were stimulated by concerns about the arms race and competing with the Communist Bloc. So too, much of the technology that we take for granted, from semiconductors to jet aircraft, from computers to composite materials, all were spin-offs of the defense industry.

Yet in the wake of the extraordinary events of the last five years--the disintegration of the Soviet Union and Eastern Europe, the reunification of Germany, and the major steps toward peace in the Middle East--the driving force of national security has disappeared, and along with it, much of the motivation for major public investment. Far from a "peace dividend" providing new resources in a post-Cold War world for investment in key areas such as education and research, instead the nation is drifting in search of new driving imperatives. While there are numerous societal concerns such as economic competitiveness, national health care, crime, and K-12 education, none of these has yet assumed an urgency sufficient to set new priorities for public investments.

Further, much of the existing intellectual infrastructure, developed to underpin national defense, is now at risk. The national laboratories are facing massive downsizing and necessarily searching for new missions. The burdens of the massive debts incurred in the buyout-merger mania of the late 1980s have forced corporate America to downsize research and development activities, including the shift of many of America's leading corporate research laboratories such as the Bell Laboratories and the IBM Research Laboratories from long-term research to short-term product development.

Equally serious are signs that the nation is no longer willing to invest in research performed by universities, at least at the same level and with a similar willingness to support understanding-driven basic research. Congress has made it clear that they will insist that universities focus increasingly on applied research, more directly related to national priorities (although many industrial leaders have tried in vain to explain that without "basic" research, there is nothing to "apply"). The federal government has yet to develop a successor to the government-university research partnership which served so well during the Cold War years.

Of course, it is certainly appropriate to seek to support "strategic" research, that is, both basic and applied research that has a high probability of contributing to national goals. And it is also the case that universities have responded to such national priorities in years past, ranging from national security to health care to agricultural or industrial development. Indeed, many of our land-grant public universities have such strategic research as an important part of their mission.

Hence the concern is not the renewed federal interest in strategic research, but rather the way that the federal government is approaching this effort. The American research enterprise triad, research universities, national laboratories, and industrial research laboratories, is generally approached through the institutional structure of Congress, where most committees and therefore budget decisions are organized around specific mission-oriented agencies (e.g., defense, energy, health, environment). While it certainly makes sense to attempt to redirect the entire American research enterprise to focus on new strategic objectives, to do so within a single committee or budget category could lead to a damaging distortion of our research capacity.

A Change from Partnership to Procurement

As we have already noted, the basic structure of the academic research enterprise of the past half century was set out in Bush's study, *Science, the Endless Frontier*,

almost fifty years ago. The central theme of the document was that the nation's health, economy, and military security required continual deployment of new scientific knowledge and that the federal government was obligated to ensure basic scientific progress and the production of trained personnel in the national interest. It insisted that federal patronage was essential for the advancement of knowledge. It stressed a corollary principle--that the government had to preserve "freedom of inquiry," to recognize that scientific progress results from the "free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for explanation of the unknown."

Since--at least in the past--the government recognized that it did not have the capacity to manage effectively either the research itself or the universities, the relationship was essentially a partnership, in which the government provided relatively unrestricted grants to support a part of the research on campus, with the hope that "wonderful things would happen." And they did, as evidenced by the quality and impact of academic research.

Unfortunately, in recent years the basic principles of this extraordinarily productive research partnership have begun to unravel, so much so that today this relationship is rapidly changing from a partnership to a procurement process. The government is increasingly shifting from being a partner with the university--a patron of basic research--to becoming a procurer of research, just like other goods and services. In a similar fashion, the university is shifting to the status of a contractor, regarded no differently from other government contractors in the private sector. In a sense, today a grant has become viewed as a contract, subject to all of the regulation, oversight, and accountability of other federal contracts. This view has unleashed on the research university an army of government staff, accountants, and lawyers all claiming as their mission that of making certain that the university meets every detail of its agreements with the government.

To be sure, we must all be concerned about the proper expenditure of public funds. But we also must be concerned about restoring the mutual trust and confidence of a partnership and move away from the adversarial contractor/procurer relationship that we find today.

Unfortunately, even the procurement model may be only a transitional stage, since in recent months there have been signs that the paradigm is continuing to shift still further to the same cost-control--or more correctly, federal cost-shifting--patterns characterizing health care. Can you imagine a system of DRG cost-reimbursement rules for basic research?

Surely the most ominous warning signs for academic research are the erosion, even breakdown, in the extraordinarily productive fifty-year partnership uniting government and universities. Scientists and universities are questioning whether they can depend on the stable and solid relationship they had come to trust and that has paid such enormous dividends in initiative, innovation, and creativity. It is truly perverse that the partnership that has been in large measure responsible for our long undisputed national prosperity and security should be threatened at very moment when it has become most critical for our future.

The Changing Paradigm of the Research University

There is an even more profound transformation occurring: that involving the paradigm of the research university itself. As one of civilization's most enduring institutions, the university has been extraordinary in its capacity to change and adapt to serve society. Far from being immutable, the university has changed over time and continues to do so today. A simple glance at the remarkable diversity of institutions comprising higher education in America demonstrates this evolution of the species.

The challenges and changes facing higher education in the 1990s are comparable in significance to two other periods of great change for American higher education: the period in the late-nineteenth century, when the comprehensive public university first appeared, and the years following World War II, when the research university evolved to serve the needs of postwar America. Today, many are concerned about the rapidly increasing costs of quality education and research during a period of limited resources, the erosion of public trust and confidence in higher education, and the deterioration in the partnership between the research university and the federal government. However, our institutions will be affected even more profoundly by the powerful changes driving transformations in our society, including the increasing ethnic and cultural diversity of our people; the growing interdependence of nations; and the degree to which knowledge itself has become the key driving force in determining economic prosperity, national security, and social well-being.

One frequently hears the primary missions of the university referred to in terms of teaching, research, and service. But these roles can also be regarded as simply the twentieth century manifestations of the more fundamental roles of *creating*, *preserving*, *integrating*, *transmitting*, and *applying* knowledge. From this more abstract viewpoint, it is clear that while these fundamental roles of the university do not change over time, the particular realization of these roles do change--and

change quite dramatically, in fact. Consider, for example, the role of "teaching," that is, transmitting knowledge. While we generally think of this role in terms of a professor teaching a class of students, who, in turn, respond by reading assigned texts, writing papers, solving problems or performing experiments, and taking examinations, we should also recognize that classroom instruction is a relatively recent form of pedagogy. Throughout the last millennium, the more common form of learning was through apprenticeship. Both the neophyte scholar and craftsman learned by working as apprentices to a master. While this type of one-on-one learning still occurs today, in skilled professions such as medicine and in advanced education programs such as the Ph.D. dissertation, it is simply too labor-intensive for the mass educational needs of modern society.

The classroom itself may soon be replaced by more appropriate and efficient learning experiences. Indeed, such a paradigm shift may be forced upon the faculty by the students themselves. Today's students are members of the "digital" generation. They have spent their early lives surrounded by robust, visual, electronic media--Sesame Street, MTV, home computers, video games, cyberspace networks, and virtual reality. They approach learning as a "plug-and-play" experience, unaccustomed and unwilling to learn sequentially--to read the manual--and rather inclined to plunge in and learn through participation and experimentation. While this type of learning is far different from the sequential, pyramid approach of the traditional university curriculum, it may be far more effective for this generation, particularly when provided through a media-rich environment.

Hence, it could well be that faculty members of the twentieth-first century university will be asked to set aside their roles as teachers and instead be become designers of learning experiences, processes, and environments. Further, tomorrow's faculty may have to discard the present style of solitary learning experiences, in which students tend to learn primarily on their own through reading, writing, and problem solving. Instead they may be asked to develop collective learning experiences in which students work together and learn together with the faculty member becoming more of a consultant or a coach than a teacher.

One can easily identify other similarly profound changes occurring in the other roles of the university. The process of creating new knowledge--of research and scholarship--is also evolving rapidly away from the solitary scholar to teams of scholars, perhaps spread over a number of disciplines. Indeed, is the concept of the disciplinary specialist really necessary--or even relevant--in a future in which the most interesting and significant problems will require "big think" rather than

"small think"? Who needs such specialists when intelligent software agents will soon be available to roam far and wide through robust networks containing the knowledge of the world, instantly and effortlessly extracting whatever a person wishes to know?

So, too, there is increasing pressure to draw research topics more directly from worldly experience rather than predominantly from the curiosity of scholars. Even the nature of knowledge creation is shifting somewhat away from the *analysis of what has been* to the *creation of what has never been*--drawing more on the experience of the artist than upon analytical skills of the scientist.

The preservation of knowledge is one of the most rapidly changing functions of the university. The computer--or more precisely, the "digital convergence" of various media from print to graphics to sound to sensory experiences through virtual reality--has already moved beyond the printing press in its impact on knowledge. Throughout the centuries the intellectual focal point of the university has been its library, its collection of written works preserving the knowledge of civilization. Yet today, such knowledge exists in many forms--as text, graphics, sound, algorithms, virtual reality simulations--and it exists almost literally in the ether, distributed in digital representations over worldwide networks, accessible by anyone, and certainly not the prerogative of the privileged few in academe.

Finally, it is also clear that societal needs will continue to dictate great changes in the applications of knowledge it expects from universities. Over the past several decades, universities have been asked to play the lead in applying knowledge across a wide array of activities, from providing health care, to protecting the environment, from rebuilding our cities to entertaining the public at large (although it is sometimes hard to understand how intercollegiate athletics represents knowledge application).

This abstract definition of the roles of the university have existed throughout the long history of the university and will certainly continue to exist as long as these remarkable social institutions survive. But the particular realization of the fundamental roles of knowledge creation, preservation, integration, transmission, and application will continue to change in profound ways, as they have so often in the past. And hence, the challenge of change, of transformation, is, in part, a necessity simply to sustain our traditional roles in society.

The 21st Century University

Of course these paradigm shifts are being driven by the extraordinary pace of change in our society. We are living in the most extraordinary of times: the collapse of communism, the end of the cold war, the impact of technologies ranging from computers and telecommunication to biotechnology, a redefinition of the world economic order, and, of course, the human population pushing against the very limits of the planet. Many believe that we are going through a period of change in our civilization just as momentous as that which occurred in earlier times such as the Renaissance or the Industrial Revolution--except that while these earlier transformations took centuries to occur, the transformations characterizing our times will occur in a decade or less! I used to portray the 1990s as the countdown toward a new millennium, as we find ourselves swept toward a new century by these incredible forces of change. The events of the past several years suggest that the twenty-first century is already upon us--a decade early!

This time of great change, of shifting paradigms, provides the context in which we must consider the changing nature of the academic research enterprise itself. We must take great care not to simply extrapolate the past and instead examine the full range of possibilities of the future.

Here we face a particular dilemma. Both the pace and nature of the changes occurring in our world today have become so rapid and so significant that our present social structures--in government, education, the private sector--are having increasing difficulty in even sensing the changes, although they certainly feel their consequences. They are simply incapable of understanding the profound changes characterizing our world, much less responding and adapting in an effective way.

Let me go further. It may well be that our present institutions, such as universities and government agencies, which have been the traditional structures for intellectual pursuits such as research, could be as obsolete and irrelevant to our future as the American corporation of the 1950s. We need to explore new social structures capable of sensing and understanding change, as well as capable of engaging in the strategic processes necessary to adapt or control change.

A case in point: For the past half-century, the Bush paradigm of federal patronage of investigator-driven research has determined the nature of the research university. Only 125 of the 3,600 institutions of higher education are research universities, but these are just the institutions at most risk as the federal science and technology budget shrinks in the years ahead. Don Langenberg,

Chancellor of the University of Maryland goes even further: “It is probably about as safe to assume that the dominate higher education institutions of the 21st century will stem from this small but powerful group of present day institutions as it would have been to assume that today’s dominate life form on Earth would stem from Tyrannosaures Rex.”

The Privately-Financed Public University

Of course, one obvious consequence of declining state support is that the leading public research universities will increasingly resemble private universities in the way they are financed. The University of Michigan has already moved far down this road to becoming a *privately-financed public university*. Over the past two decades, the share of the University of Michigan's support provided by state appropriations has declined to the point today where it comprises only 18% of our academic budgets (non-auxiliary funds), and 10% of our total revenue base.

Further, it seems clear that if the present rate of deterioration continues, by the end of the decade, state support will amount to less than 7% of our total resources. In a sense, long ago we ceased to be a state-supported university. Indeed, today, we are, by most measures, not even a strongly state-assisted university, since other shareholders--students and parents through tuition, the federal government through research grants, alumni, friends, and benefactors through gifts, and patients through health care fees--each provide more support to the University than does the State of Michigan. Yet, despite the low level of state support, the University remains a public university, committed to serving the citizens of Michigan. Further, it is clearly governed by the state through its publicly-elected Board of Regents.

Hence, the University of Michigan has already become a *privately-financed, public* university, supported by a broad array of constituencies at the national--indeed, international--level, albeit with a strong mission focused on state needs. Just as a private university, it must earn the majority of its support in the competitive marketplace (i.e., via tuition, research grants, gifts). Yet it still retains a public character, committed to serving the people whose ancestors created it two centuries earlier. While the University of Michigan was one of the first public university to see its state appropriations drop to such a low fraction of its operating budget, it is now being joined by other major public universities facing a similar privately-financed future--most notably the University of California, the Big 10, and a number of eastern public universities (Virginia, New Hampshire, Massachusetts).

Today one might even conclude that America's great experiment of building world class universities supported by public taxes has come to an end. Put another way, it could well be that the concept of a world-class, comprehensive state university may not be viable over the longer term. It may not be possible to justify the level of public support necessary to sustain the quality of these institutions in the face of other public priorities such as health care, K-12 education, and public infrastructure needs--particularly during a time of slowing rising or stagnant economic activity.

There are important issues raised by the "privatizing" of the support base for public higher education. For example, how does one preserve the public character of a privately-financed institution? How does a "state-related" university adequately represent the interests of its majority shareholders--namely, parents, patients, federal agencies, and donors--in its governance? Can one sustain an institution of the size and breadth characterizing our leading public research universities on self-generated ("private") revenues alone?

Keep an eye on Ann Arbor. We are, of necessity, exploring this brave new world of privately-financed public education!

Back to the Future

The anticipated decline in federal support of university-based R&D in the years ahead will inevitably cause a variety of responses on the part of both public and private research universities. Many university faculty will shift from the public to the private sector for support to accommodate the erosion in federal support. Beyond seeking corporate support for R&D, they will need to market more aggressively educational services and put in place more realistic prices structures (e.g., tuition and fees) that accurately reflect costs.

But there are more profound shifts that will likely occur in the character of institutions. Clearly, to thrive in the more competitive marketplaces of the 21st Century, universities must shift from the "faculty centered" cultures of research universities to the "student-centered" enterprises of land-grant institutions...that is, in the language of the business world, from "provider-centered" to "customer-market".

But there is an even more subtle shift that I believe may occur. There could be a shift in public attitudes toward universities that will place less stress on values such as "excellence" and "elitism" and more emphasis on the provision of cost-

competitive, high quality services--from "prestige-driven" to "market-driven" philosophies.

Let me elaborate a bit on this third issue. For the past half-century, the Bush paradigm characterizing the government-university research partnership has been one built upon the concept of relatively unconstrained patronage. That is, the government would provide faculty with the resources to do the research they felt was important, in the hopes that at some future point, this research would benefit society. Since the quality of the faculty, the programs, and the institution was felt to be the best determinant of long term impact, academic excellence and prestige were valued.

Yet, today society seems reluctant to make such long term investments. Rather, it seems interested in seeking short term services from universities, of high quality, to be sure, but with cost as a consideration. In a sense, it seeks low-cost, quality services rather than prestige. The public is asking increasingly, "If a Ford will do, then why by a Cadillac?"

Perhaps rather than moving ahead to a new paradigm, we are in reality returning to the paradigm that dominated the early half of the 20th century...the "land-grant university" model. In fact, perhaps what is needed is to create a contemporary land grant university paradigm.

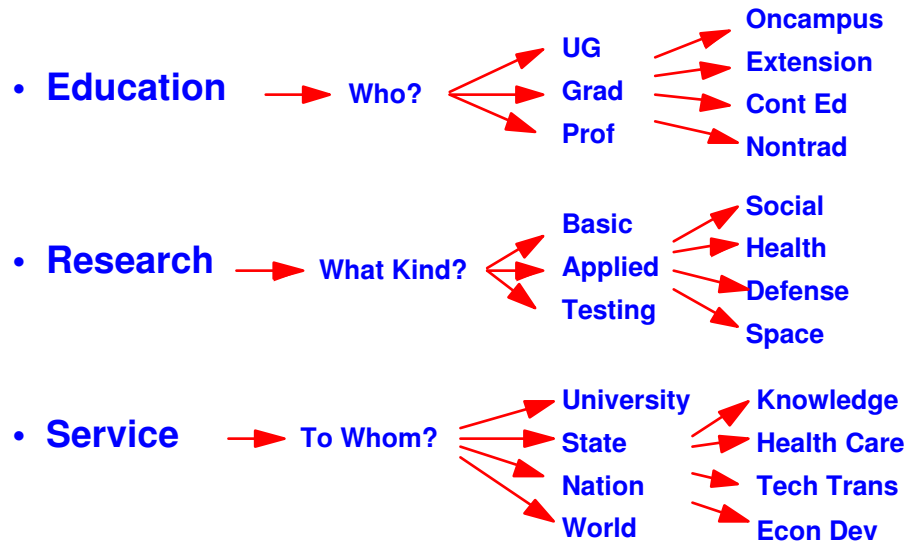
As Frank Rhodes and other leaders of public universities have stressed, the land-grant paradigm of the 19th and 20th centuries was focused on developing the vast natural resources of our nation. The agricultural and engineering experiment stations and the cooperative extension programs were enormously successful. Today, however, we have come to realize that our most important national asset for the future will be our people. Hence a contemporary land-grant university might be focused on human resource development along with the infrastructure necessary to sustain a knowledge-driven society.

The Transformation of the Research University

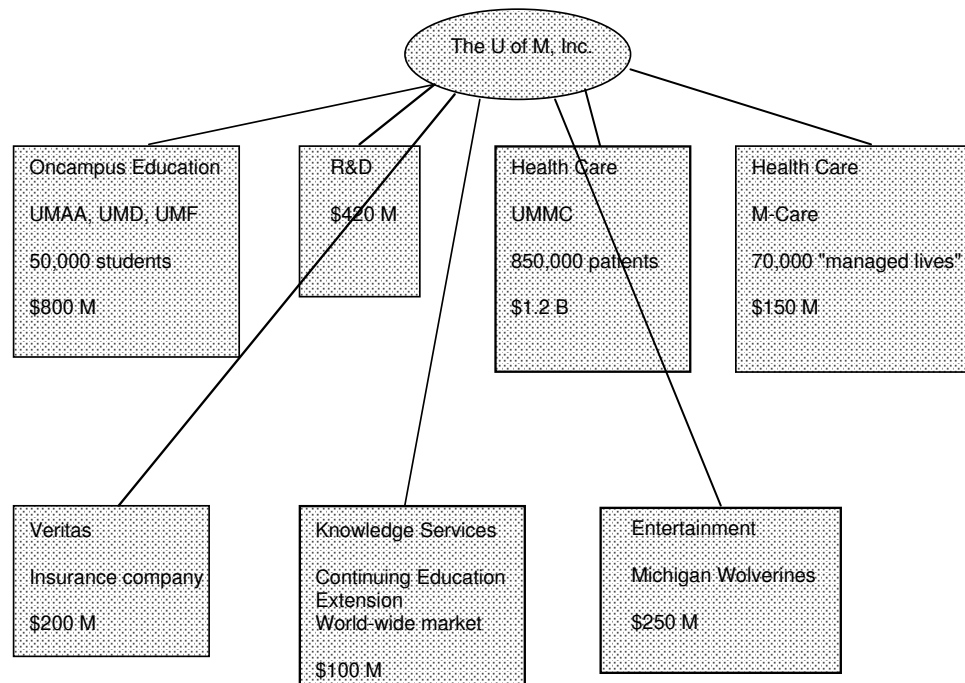
The nature of the contemporary university and the forces that drive its evolution are complex and frequently misunderstood. The public still thinks of us in very traditional ways, with images of students sitting in a large classroom listening to a faculty member lecture on subjects such as literature or history. Our faculty have more of an Oxbridge image, thinking of themselves as dons and of their students as serious scholars. The federal government thinks of us as just another

R&D contractor or health provider, a supplicant for the public purse. Yet the reality is far different--and far more complex.

The reality is something quite different, as a brief analysis of our mission will indicate. While we generally all start from the classic triad of teaching, research, and service, the various forms these general missions branch into stretch on and on.



Let me suggest a different image of the modern research university: that of a very complex, international conglomerate of highly diverse businesses. Consider, for example, an organizational diagram of "the U of M, Inc":



The U of M Inc., with an annual budget of over \$2.5 billion per year, would rank roughly 300th on the Fortune 500 list. We have several campuses where we educate about 50,000 students at any one time, about an \$800 million dollar a year operation. We're a very major federal R&D laboratory, over \$440 million dollars a year worth of grants and contracts. We run a massive health care company. Our medical center treated over 800,000 patients last year. We have a managed care operation with 100,000 "managed lives". Last year we will formed a nonprofit corporation, the Michigan Health Corporation, which will allow us to make equity investments in joint ventures to build a statewide integrated health care system building to roughly 1,500,000 subscribers, which is the size of a population we believe necessary to keep our tertiary hospitals afloat (which unfortunately we own). We're already too big to buy insurance, so we have our own captive insurance company. We've become actively involved in providing a wide array of knowledge services, from degree programs offered in Hong Kong, Seoul, and Paris, to cyberspace-based products such as managing part of the Internet. And of course, we're involved in entertainment--the Michigan Wolverines. That \$250 million you see under the Michigan Wolverines is not our athletic budget, but when you represent licensing and everything else we do, that's about the magnitude of it.

In many ways, the university today has become the most complex institution in modern society--far more complex, for example, than corporations or governments. We are comprised of many activities, some nonprofit, some

publicly regulation, and some operating in intensely competitive marketplaces. We teach students; we conduct research for various clients; we provide health care; we engage in economic development; we stimulate social change; and we provide mass entertainment (...athletics...). In systems terminology, the modern university is a loosely-coupled, adaptive system, with a growing complexity as its various components respond to changes in its environment.

That is, the modern university has become a highly adaptable knowledge conglomerate because of the interests and efforts of our faculty. We have provided our faculty the freedom, the encouragement, and the incentives to move toward their personal goals in highly flexible ways. In a very real sense, the university of today is a holding company of faculty entrepreneurs, who drive the evolution of the university to fulfill their individual goals. We have developed a transactional culture, in which everything is up for negotiation.

But, while the entrepreneurial university has been remarkably adaptive and resilient throughout the twentieth century, it also faces serious challenges. Many contend that we have diluted our core business of learning, particularly undergraduate education, with a host of entrepreneurial activities. We have become so complex that few, whether on or beyond our campuses, understand what we have become. We have great difficulty in allowing obsolete activities to disappear. Today we face serious constraints on resources that no longer allow us to be all things to all people. We also have become sufficiently encumbered with processes, policies, procedures, and past practices that our best and most creative people no longer determine the direction of our institution.

To respond to future challenges and opportunities, the modern university must engage in a more strategic process of change. While the natural evolution of a *learning organization* may still be the best model of change, it must be augmented by constraints to preserve our fundamental values and mission. We must find ways to allow our most creative people to drive the future of our institutions.

Our challenge is to tap this great source of creativity and energy associated with entrepreneurial activity, but in a way that preserves our fundamental mission and values. We need to encourage our tradition of natural evolution but do so with greater strategic intent. Instead of continuing to evolve as an unconstrained transactional entrepreneurial culture, we need to guide this process in such a way as to preserve our core missions, characteristics, and values.

Concluding Remarks

There is an increasing sense among leaders of American higher education and on the part of our various constituencies that the 1990s will represent a period of significant change on the part of our universities if we are to respond to the challenges, opportunities, and responsibilities before us. A key element will be efforts to provide universities with the capacity to transform themselves into entirely new paradigms that are better able to serve a rapidly changing society and a profoundly changed world.

Hence it has become clear that the challenge of the years ahead will be one of institutional transformation. The task of transforming the University to better serve our society and to move toward the visions proposed for the century ahead will be challenging. Perhaps the greatest challenge of all will be the University's very success. It will be difficult to convince those who have worked so hard to build the leading public university of the twentieth century that they cannot rest on their laurels and that the old paradigms will no longer work. The challenge of the 1990s is to reinvent the University to serve a new world in a new century.

We must seek to remove the constraints that prevent our institutions from responding to the needs of a rapidly changing society, to remove unnecessary processes and administrative structures, to question existing premises and arrangements, and to challenge, excite, and embolden the members of our university communities to embark on this great adventure. Our challenge is to work together to provide an environment in which such change is regarded not as threatening but rather as an exhilarating opportunity to engage in the primary activity of a university, *learning*, in all its many forms, to better serve our world.

The world and the structure of academic research have changed greatly since Vannevar Bush wrote his report. However the major principles he advanced merit reaffirmation. Now more than ever before the national interest calls for an investment in human and intellectual capital. As Bush so clearly stated it, the government-university partnership is not simply about the procurement of research results. It is also about nurturing and maintaining the human strengths of a great technological nation and sowing the seeds of innovation that will ultimately bear fruit in new products and processes to fuel our economy and improve our quality of life.

The American public, its government, and its universities should not surrender the long-term advantage of this research partnership because of a short-term loss of direction or confidence. At a time when many of society's other institutions do not seem to be working well, the research university is a true success story. We

simply must get that message across to the American public. We must re-articulate and revitalize the remarkably successful partnership that has existed between our government, our society, and our research universities over the past four decades.

Indeed, the world--and the structure of R&D--has changed a great deal since Bush wrote his report. But the major principles he advanced in it merit reaffirmation. The long-term national interest still calls for investment in the human and intellectual capital that are essential, ultimately, to national prosperity and security.