

AAU Public Affairs Network Meeting

“The Research University of the Future”

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March 22, 2010

Thank you, Bob, for the very nice introduction and for the opportunity to participate in this annual gathering. You’ve given me a daunting topic to address . . . The Research University of the Future. I’m sure you all know Yogi Berra’s great line about predictions. I have never found it more apt than when I began preparing for this session.

To a degree none of us has witnessed in our lifetimes, our nation’s research universities are in a period of both feast and famine. There is a veritable feast of existing areas of research, many of which address pressing national needs, which are ripe for transformative breakthroughs. I think of areas like stem cell research, with the potential to cure Parkinson’s disease and injury-induced paralysis, maybe even Alzheimer’s; personalized medicine, enabled by the human genome project; alternative sources of energy that could make the U.S. energy-independent; particle physics, which is on the verge of answering existential questions about the origins of the universe; neuroscience and its ability to understand and correct cognitive deficiencies...and on and on the list goes. The coming decade has the potential to be an unprecedented era of discovery on fundamental questions many of us thought could not be answered in our lifetimes.

On the other hand, as you are painfully aware, we are also in a period of fiscal famine, experiencing unprecedented resource trauma that threatens the ability of many, if not most of our institutions to carry out their core missions. Two notable features of this particular fiscal trauma are that, first, it seems to have impacted comparably both public and private universities.

I never thought I would see the day when our best endowed private universities would have to borrow money to meet annual operating expenses, lay off staff and close programs. Nor could I have imagined public universities furloughing Nobel Prize winners and other distinguished faculty. The breadth and depth of the fiscal carnage are both stunning and debilitating.

The second notable feature is the dim prospects for recovery in the foreseeable future. We have, of course, experienced periods of fiscal

decline in the past, one as recent as the early part of this decade. But, this decline has a different character. In the past, economic downturns were followed by periods of economic boom and losses were recovered relatively quickly. I know no one who predicts that will be the case with our current fiscal decline.

In a very well written piece Bob Berdahl prepared for the National Academy of Sciences, he notes that, even if investment returns averaged 10% into the future, it could well take 10 to 15 years for endowments to return to their values before the fiscal collapse. That's because with a 5% payout rate and, say 3% inflation, a 10% return will only allow a 2% growth in the corpus, which for many institutions is down between 20 and 30%.

The prospects in the public sector are, if anything, worse. Writing in *The Chronicle of Higher Education* this year, Paul Courant, James Duderstadt and Edie Goldenberg describe a "failing" partnership between the states and federal government. They write, and I quote:

"Today, the state side of the partnership is failing. Public institutions of higher education are gravely threatened. State support of public universities, on a per student basis, has been declining for over two decades; it was at the lowest level in 25 years even before the current economic crisis. As the global recession has deepened, declining tax revenues have driven state after state to further reduce appropriations for higher education, with cuts ranging as high as 20% to 30%, threatening to cripple many of the nation's leading state universities and erode their world-class quality."

As bad as this is, worse could be on the public sector's doorstep. Many states, including California and Michigan, have propped up higher education in part by providing substantial stimulus funds in public university education budgets. These funds won't be there in FY 2011 and, when they go away, one of two things will happen: States will find General Funds to replace the stimulus funds or these states will face another precipitous decline in support. I don't know anyone who thinks the former is a realistic possibility. I guess we could hope for a new round of stimulus funding, but with the national debt soaring and the other demands for funds at the federal level, I don't think this is a realistic possibility either.

Most universities have relied on huge tuition increases to offset the loss of public funds. While this has certainly buffered the drop in state support,

it seems unlikely that tuition can continue to go up at anything like the rates of the past several years much longer.

Meanwhile, President Obama and others have issued a clarion call for the U.S to recapture the global leadership in the percentage of the U.S. population with a college degree. Ironically, many of the states with the largest growth in college-age populations are the very ones with the deepest cuts in public funds. The disconnect between the aspirational rhetoric at the national level and the reality on the ground, so to speak, in our states was evident a few months ago when, in the same week, President Obama announced his laudable goal for leadership in higher education completion rates and Charlie Reed, Chancellor of the California State University System, announced that Cal State was turning away 30,000 students this spring because of inadequate funding.

All this makes it seem clear that, if we haven't already, we could be about to hit a financial wall that could crush our aspirations for global leadership in the education of our citizens and for achieving the great research breakthroughs that seem within our grasp.

Meanwhile, much of the rest of the world, especially Asian countries, is making huge investments in building the higher education infrastructure, including impressive investments in research. In fact, the swiftness of the fall of fortunes in the U.S. has been more than matched by the speed of the rise of investments elsewhere. While most of the rest of the world has for decades been content, or at least forced to accept U.S. dominance in science and technology research, this is no longer the case. The search for talent and knowledge has gone global at a dizzying rate. We've all read about the huge investments in higher education and research in China, Taiwan, Korea and India. I'm sure many of you have seen the results of these investments first hand.

China is a particularly dramatic example of the global pursuit of the highest possible standard of excellence and of the competition we face for research and education leadership and knowledge generation. The Chinese government now spends billions of Yuan—close to 2% of its gross domestic product—on higher education annually. China has more than doubled the number of higher education institutions over the past 10 years, from 1,022 to 2,263. Five million Chinese students enroll in degree courses now, compared to one million a decade ago.

But China isn't just after numbers. It has a specific goal of bringing its best institutions, like the universities of Tsinghua and Peking, into the world's top 10. In a speech to the Royal Society in London this year, Rick

Levin, president of Yale University, stated that China's top universities will rival Oxford, Cambridge, and the Ivy League within 25 years' time. *The Financial Times*, in a front-page story on January 26, 2010, reported that China already leads the world in growth of scientific research and is now the second largest producer of scientific knowledge, on course to overtake the U.S. by 2010, if it continues on its present trajectory.

For me, one anecdote vividly captures the global pursuit of talent now underway. It concerns Choon Fong Shih, a name that may be familiar to many of you. Dr. Shih was born in Singapore and educated at Harvard. He rose through the academic ranks at Brown University and established himself as one of the world's leading experts on fracture mechanics. In 2000, he became the chancellor of the National University of Singapore and is widely credited with building that university into a research powerhouse of international stature. So far, this is a story that has parallels in other Asian countries, Taiwan most notably . . . brilliant Asian scientists get educated in the U.S., have distinguished academic careers, return home to lead major institutions. But, this story has a twist.

A few years ago, as I'm sure you know, King Abdullah of Saudi Arabia decided to build a world-class center of academic and research excellence called, not immodestly, the King Abdullah University of Saudi Arabia or KAUST. It opened its doors in 2009. The university was launched with a \$10 billion endowment and the best facilities money can buy. Given the benefactor, no surprises here . . . But, what is striking about this story is that, in one of the world's most closed societies, the university has cast its net for talent as broadly as possible. Dr. Shih was recruited to become its president. Moreover, KAUST is open to men and women alike. Women are not required to wear veils and the religious police are not permitted on the campus. If this can happen in Saudi Arabia, can there be any doubt that the global race and competition for talent is on.

These dynamics—decline in higher education investment in the U.S. and soaring investments in other parts of the world—have not gone unnoticed in Washington. It is this environment that led Congress to ask the National Academies to conduct a study on U.S. competitiveness, which resulted in the well-received and much-referenced *Rising Above the Gathering Storm* report. In a city where reports tend to have a very short half-life, this report led to something...the America Competes Act, although funding for the act has been a bit underwhelming to date.

Now, a new study is in the works. Four members of Congress, including my own Senator Barbara Mikulski, have asked the Academies to conduct a study of the global competitiveness of America's research universities.

The study has been assigned to the Board on Higher Education and the Workforce, which I chair, but has the attention at the highest levels of the Academies.

Specifically, the study is supposed to answer the following question, and I quote: "What are the top ten actions that Congress, the federal government, state governments, and others could take to assure the ability of the American research university to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, the environment, and security in the global community of the 21st century?"

The study is to take 12 months and the study committee is now being formed. Its chair will be Charles O. Holliday, a member of the National Academy of Engineering and Chairman and former CEO of DuPont.

As I mentioned earlier, Bob Berdahl has written an excellent paper that frames some of the issues that the committee should address. As some of you in the public sector may know, the Association of Public and Land-grant Universities (APLU) is planning a series of regional meetings so that member institutions can discuss and hopefully inform the work of the study committee. I personally think this is an extremely important and timely study, which I hope will lead to a national agenda for reinvesting in our research universities.

Some have suggested, that we need the federal government to step up and provide direct support to our leading research universities. My personal view is that such an investment is unlikely for both political and fiscal reasons. But, I think the report could result in some very important recommendations that would bring welcome relief and new investment to our research universities. My top candidate ideas are also on Bob Berdahl's list. First, I would like to see the federal government pay the full cost of doing research. States have no money and the federal government's failure to pay these costs is eroding our institutions' infrastructure and placing precious institutional resources to support research in direct competition with strapped budgets for education.

We also need to place federal research budgets on a predictable steady rate of increase. The boom and bust cycles of the past several decades have a debilitating impact on research programs and often stop promising work in midstream.

Another crucial item in my view would be to restart a robust capital research facilities program. At many fine universities, my own included,

the quality and quantity of research space have become serious impediments to advancing our research agenda.

Other important items will be put on the table. My hope is that we can rally consensus among the nation's research universities for a coherent and focused set of priorities. If we do, I am optimistic that this study and report could make a huge difference in the nation's support for our research universities.

This brings me to my original charge . . . the research university of the future. With Yogi's admonition ringing in my ears and a real sense of trepidation, I will offer a few thoughts on this topic.

First, an observation: at the start of any previous decade in my lifetime, if someone had predicted that universities would operate their education and research programs at the end of the decade more or less like they operated them at the beginning of that decade, they would have been right. But, I am absolutely convinced that such a statement in 2010 will be proved dead wrong in 2020. We are on the cusp of huge change in the way we carry out our educational and research missions, and for that matter our business operations. These changes will be forced on us by the fiscal challenges we face and the intense global research competition and opportunities we will experience. However, they will be much more pronounced in so-called STEM areas than in the Arts and Humanities and the Social Sciences.

I'll expand briefly on these points. First, while our research mission is near and dear to our hearts, we cannot neglect our educational responsibilities. Our nation's competitiveness requires that we significantly increase the proportion of young people getting a college degree. We simply can't be the kind of nation we want our children and grandchildren to inherit if higher education does not step up to this challenge. But, where will the resources be to meet this challenge, you ask? The answer is, they won't be there.

This means we must find new, lower cost means of delivering high quality education. I know that will sound blasphemous to many . . . and if carried out could actually even cause a drop in a school's *U.S. News* rankings!

But, there simply is no alternative! And our nation's research universities must lead this effort. I say this because we have the greatest need to conserve resources so that we can carry out our broader mission. But, I

say it also because, quite frankly, we have the kind of creative faculty who can actually pull this off.

Fortunately, there are models out there that demonstrate how technology can be used to both lower the cost of undergraduate education and improve student learning. Now that is a powerful combination! In this day and age, how can *any* university resist pursuing such an agenda?

Let me briefly describe two strategies that have produced impressive results. The first is an effort launched by [Carol Twigg](#) more than a decade ago. At the time, Carol was at Educom. For several years, she had observed the ineffectiveness and inefficiency of the education delivery models in the multi-section, lower division, general education courses that exist on most of our campuses. In these courses, students are captive participants in a passive learning environment. For the most part, students' dislike of the courses is matched only by the faculties disdain for teaching them.

Carol concluded there had to be a better way. Armed with a grant from The Pew Charitable Trust, she ran a controlled experiment of sorts on 30 campuses: small liberal arts colleges, state flagship universities, and elite private institutions. Each campus had to teach sections of a course using her strategies, which were based on active learning, technology-enhanced online and face-to-face tutorials, and many fewer formal lectures. The institutions also taught sections of the same course using their traditional methods, but all sections took a common final. In every case – at all 30 institutions – the Twigg sections scored higher on the finals and had a cost that was the same or lower than that of the traditional sections.

The University System of Maryland hired Carol as a consultant for a three-year period. Under her guidance, each of our campuses developed “Twigg” models in lower division, multi-section courses. We found the same results as in her benchmark study. In all cases, the “Twigg” sections did better and at the same or lower cost than the sections taught using traditional methods.

The Carnegie Mellon example is a similar but even more sophisticated approach. With a grant from Hewlett Packard, Carnegie Mellon has drawn upon the expertise of its cognitive science faculty to develop computer enhanced learning modules and online tutorials for some of the same category of courses addressed by Carol Twigg. CMU conducted an experiment with its freshman Statistics course. Some students took the course in a traditional format; some took the course in the traditional format but using some of the computer-based cognitive learning

strategies; and a third group took the course using predominately the computer based materials, with once a week faculty interactions. Interestingly, the third group did the best on the uniform final, the computer enhanced sections did second best, and the traditional sections the worst.

These are very compelling examples. In era where there is a scarcity of funds and there are technology-based, active learning strategies that both lower costs and improve learning in lower division courses, can a revolution in how we deliver instruction be far behind?

So, the first way our universities will differ in 2020 is that none of us would recognize today the "classrooms" where students are learning and the means by which instruction is delivered 10 years from now.

There will also be significant changes in where and how research is done in STEM areas. The great centers of research, in these fields, will be much more widely dispersed around the globe. We already see the precursor of this phenomenon with the linear accelerator at CERN. While strong research in particle research will continue to exist in the U.S., many if not most of the real breakthroughs will come by teams, no doubt with U.S. membership, working in Switzerland. But, by 2020, we should expect to see quite a few other centers of cutting edge research elsewhere in Europe and in Asia. Going back to Rick Levin's talk, we can get a glimpse of the transformation under way. He pointed out that Yale has a strong research partnership in the biosciences with a Chinese university and that Yale has found some competitive edge in sending researchers there rather than having them come to New Haven. The reason is that the cost of doing the research is lower, the facilities are superb, and there are plenty of talented graduate students.

I also believe we will see fewer research universities in the U.S. by 2020, and a narrower portfolio of research activities at our major research universities. While there may be a few exceptions, I don't believe universities will be able to aspire to "excellence across the board" in research. The funds simply won't be there to maintain competitive research programs in a wide swath of areas when the competition isn't just 50 or 60 other U.S. universities, but three or four times that number spread around the globe.

Another challenge for our research universities will be attracting adequate numbers of talented graduate students. Foreign graduate students already dominate many of our best science and engineering programs. While numbers have declined slightly, our universities are still seen as

offering the best graduate education opportunities and we have had our pick of exceptional students. This has been our salvation since U.S. colleges and universities are not producing enough domestic science and engineering graduates to fill the need in our graduate programs. We certainly cannot count on this flow of foreign students in the coming years as strong research centers evolve in other parts of the world. We must start now to build the pipeline of well-educated and motivated domestic students in STEM areas or face the prospect of a significant shortfall in graduate students, who are absolutely essential to maintaining excellent research programs.

Perhaps all of this sounds a bit alarmist and depressing. But, there are positive aspects to this scenario as well. The kind of global expansion of knowledge creation that seems inevitable, will almost certainly lead to significant improvements in the standard of living and the quality life around the world. And, while we may have to share more of the limelight on breakthrough research discoveries, the competition and collaboration on a broader scale will undoubtedly accelerate advances and make us better at what we do.

Let me close by coming back to the study of research universities. Given what we will be facing fiscally within our nation and competitively with other nations in the coming decade, this study is extremely important. I think it is crucial that AAU institutions develop, perhaps in partnership with APLU, a consensus agenda. Bob Berdahl's paper is an excellent start toward that objective. If a consensus could emerge, I believe there is a once in a decade or two opportunity to take a major step in advancing the research agenda of our universities. I see the group in this room as especially critical to this effort.

Thank you for listening to me today. I would be pleased to respond to question or learn from any observations you may have on my remarks.