Change and the Research University

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The question "What will the great research university of the mid 21st century look like?" tends to be met with a reaction that implies that the answer is too obvious to merit serious discussion. In an academic version of Word Association, the prompt "research university" seldom elicits a response of "change." Indeed, the popular perception - both inside and outside of the academy - of the American research university is that it provides an island of stability in the midst of a changing world, and that it will be pretty much the same fifty years from now as it is today. However, even a cursory look at the history of the research university shows that it has evolved in very significant ways over the past half century in response to wars, governmental focus and reactions, and changing social and economic conditions. Unless the world somehow has reached a new and unprecedented level of stability, we should expect that the university will experience an evolution over the next half century that will be as significant as that which occurred over the last.

So an effort to answer the question that began this essay should start with a review of the events of the past and an analysis of how those events created the research university of the beginning of the 21st century. In order to keep this discussion to a reasonable length, I will focus roughly on the period from 1940 to the present, with only brief excursions into earlier periods. This is not meant to be an exhaustive analysis of the complex interactions that drove university change during the 20th century, but rather a broad overview that points out some of the major forces that drove those changes.

The story of the research university - as opposed to the college - in America starts with the founding of Johns Hopkins University in 1876. Hopkins introduced a Germanic model of research and graduate education to the United States that was rapidly copied by a number of new and existing institutions during the remaining years of the 19th century. Most of these new research universities were funded by private philanthropy, but several were public land grant institutions. However, funding for the research required by this expensive model was a major obstacle from the outset, and the American research enterprise suffered greatly in comparison with that of Europe. In

the 1890's, in what can only be described as one of the most momentous breakthroughs in higher education, Yale and Harvard came to understand that they could call upon their alumni for significant annual support.[1] This continuing alumni support enabled these, and a few other similarly placed universities, to grow the research enterprise significantly. Around the turn of the century, many of the great industrialists of the 19th century created foundations, and many of those foundations provided major support for university research. The Federal government provided almost no direct support for research during the first half of the 20th century, but some government policies served to greatly (albeit indirectly) support research and the growth of the research university. Most notably, private philanthropy received significant boosts from the Revenue Act of 1917, the 1921 Estate Tax Law, and 1932 Tax Act, which introduced and then codified charitable deductions. In fact, much of academe in the first half of the 20th century was opposed to direct government support of research because of fear that such support could constrain academic freedom. Corporate supported research in universities began to appear at significant levels in the 1920's. However, this support was also quite controversial, and not all universities were prepared to accept it.

Thus just before World War II, the basic structure of the research university that we know today - the mixture of undergraduate education, graduate and professional education, and research - was in place. However, the research and graduate training function was supported almost exclusively by philanthropy, which was insufficient to enable American universities to compete on an equal footing with most of their government supported Continental competitors. Research and graduate training, although an integral part of the mission, were carried out at a fairly low level.

Before moving to a more detailed look at key events of the period beginning with WWII, I want to briefly jump back three and one half centuries to René Descartes. USC's Stephen Toulmin has eloquently argued the central role played by Descarte's philosophy in defining the approach and outlook of the research university, and it is important to understand that role in order to put more recent events into a context.[2] Descartes led a movement searching for "rational" bases for beliefs and knowledge. This movement called for the basic theories of knowledge to be based on step-by- step, demonstrable arguments, with the theorems of geometry

providing the example. Such an approach required that problems be addressed in a decontextualized way, that is, separate from any historic or similar complexities. This viewpoint obviously de-emphasizes questions of practical, contextual impact, and emphasizes the importance of the search for universal, rational truths. Toulmin takes Descartes' work as the beginning and basis of the era of Modernity, the period in which the great universities of Europe began to flower. Thus the Cartesian idea of the superiority of the search for rationally determined universal truths over the effort to solve contextually complicated practical problems was naturally incorporated into the missions of most great European universities. This value-ordering of intellectual goals was imported without change into the new American research university. Consequently, it is within the context of this Cartesian bias that we must view the changes that occurred in the research university during the last half of the 20th century.

Much of the discussion that follows will focus on science and technology in the university. This is not to devalue other fields of intellectual pursuit, but is a reflection of the fact that the construct of Modernism leads to a particularly central role for science. This central role has been eloquently articulated by Bloland:

> "For one hundred fifty years, higher education has promoted the concept that science and its forms, science research, scientific methods, and the progress that results from science, are the principal guarantors of the legitimacy of higher education."[3]

Thus changing societal views and expectations of science are a good indicator of changing societal expectations for higher education as a whole.

The Second World War marked the beginning of a very critical 60 year period for the research university. I want to focus on nine events during that period that ends with the turn of the century. These events are important both because of their impact on the evolution of the research university at the end of the 20th century, and because they reflect changing societal goals for the university. They are, of course, not the only events of importance to the development of the research university, but they do enable us to begin to see the outline of the change.

1. <u>WWII:</u>

As noted above, prior to the war, there was very little government-funded research in

universities. With the advent of the war, large numbers of academics were drawn into the war effort in areas that utilized their advanced training. Some of these stayed at their universities to carry out war-related research in their own laboratories, now supported with new federal funds. Others went to new free-standing laboratories set up by the government to do war-related research. Still others went into various non-technical aspects of the effort, such as military intelligence. When the war reached its successful conclusion, the contributions of American academics to the effort proved critical. They enabled advances in key areas as diverse as sonar, radar, proximity fuses, code breaking, and, of course, nuclear weapons. America had discovered that academia provided an invaluable resource that could be called on in time of need. This discovery set the stage for major changes in the government-university relationship in the immediate post-war period.

2. The immediate post-war period

Vannevar Bush, director of the wartime Office of Scientific Research and Development, prepared a report for President Rosevelt in 1945 that sought to explain the lessons regarding research that the nation needed to learn from the war. This report, Science, the Endless Frontier, became very influential in setting the postwar science policy of the United States, and in institutionalizing federal research support for universities.[4] Because of the key importance of this new federal funding in the evolution of the research university, this report and its approach played a major role in defining the outlook of the post-WWII university. From the perspective of the development of universities, Bush's report was important in that it set or reinforced two paradigms. First, it reinforced the Cartesian view of research. Bush described basic research in rather strict terms: "basic research is performed without thought of practical ends. It results in general understanding of nature and its laws."[5] Applied research, by contrast, involves the application of the results of basic research to practical problems. Thus basic and applied research were mutually exclusive in that the former must be done "without thought of practical ends," whereas the latter must focus on those ends. In addition, Bush emphasized that without excellent basic research, one could not have excellent applied research, thus reinforcing the primacy of basic over applied. Universities were, in Bush's opinion, the right place to do basic research, with applied research to be carried out in other kinds of institutions. Secondly, Bush saw the value of government support

of university research through a long-term, policy lens. The job of the government was to further the health and welfare of the nation, and increased scientific capital would help to accomplish that. Scientific capital included both scientific information, and trained researchers. Further, since one never could predict what areas of basic science would be most important in enabling needed applied research, it was necessary that government support the broadest possible spectrum of basic research. In the discussion below, I will always use "basic" in the V. Bush definition.

Much of Bush's proposed program of support for investigator driven basic research was not implemented until several years after the war, and much that the government did organizationally immediately following the war was not in keeping with what Bush suggested. For example, the National Institutes of Health (NIH) were founded in 1947, organized around the practical issue of specific diseases. The research arms of the Department of Energy (then the Atomic Energy Commission) and Department of Defense were likewise focused on applied goals. All of these agencies (and more) funneled relatively huge amounts of money into research universities following the war. In almost all cases, however, the agencies took to heart Bush's admonition that excellent applied research required the precursor of excellent basic research, and provided significant funding for the latter, sometimes over a surprisingly broad area. In addition, Bush's insistence that basic research funds should go to universities rather than to other types of institutions was critical in determining that American basic research takes place primarily in universities, rather than in stand-alone research institutes as occurs in many other countries. The preponderance of the early post-war university support of basic research went into the rather more Cartesian physical sciences, centered, of course, in schools of arts and sciences.

Finally, although Bush's report focused on the sciences, he signaled the importance of other areas of research to the nation in a section called "A Note of Warning." In this, he wrote "It would be folly to set up a program under which research in the natural sciences and medicine was expanded at the cost of the social sciences, humanities, and other studies so essential to national well being." However, it is to be noted that in the formation of the NSF, Bush was viewed as opposed to the inclusion of the social sciences.

One additional major event of the immediate post-war era must be mentioned - the GI bill.

This allowed huge numbers of individuals to go to college, and changed expectations for college attendance forever in the United States. The huge inflow of new students enabled universities to expand greatly, which led to a greatly increased demand for new faculty. The new tuition resources produced by the GI Bill, and the increasing demand for new faculty led to increases in Ph.D. student populations across almost all fields. The combination of increased government support of science, and increasing number of Ph.D. students led to an explosion in research output from American universities.

3. The Cold War

The Cold War was both a physical and psychological battle with the Soviet Union. In response to the physical threat of the USSR, the US government greatly increased funding into universities for applied research that could be useful in creating new weapons systems. However, there was also a battle for the hearts and minds of the unaligned peoples of the world. In order to win this battle, it was important to demonstrate that our society was better, more advanced, than that of the USSR. In order to do this, what better than Cartesian research that sought to uncover universal truths, such as could be found in basic areas such as astronomy or high energy physics? Thus, one consequence of the Cold War was a large increase of federal research funding into universities in both applied and basic areas. Over the long period of the Cold War, the basic/applied balance of funding varied significantly, with the early days having a distinct applied balance, at least in the sources of funding. The Bush-Cartesian emphasis on the primacy of basic research in universities was weakened during periods in which there was a relatively large influx of applied funds, but support of basic work was always significant enough to keep the paradigm alive and useful in arguing for increased funding.

4. Sputnik

The launch of Sputnik in 1958 was galvanizing for the US government and public. This was a signal that the USSR might be winning the technology component of the Cold War. It also struck directly at the cultural component of the war, because this was a demonstration that the USSR had taken the lead in the Cartesian field of astronomy. The response of the government was immediate and massive. Funding for university research shot up dramatically in the years

immediately after Sputnik. Importantly, most of this increased university funding followed the policy outlines of Vannevar Bush, that is, the preponderance of this increase went into basic rather than applied research. For example, the NSF budget alone increased from $40 million to $240 million between 1958 and 1964.[6] The creation of human capital was not forgotten either, and huge increases occurred across the sciences in support of Ph.D. students. This post-Sputnik response played a central role in creating the heavily federal-funded research programs that characterize the modern research university. It also marked what was perhaps the high water mark of the realization of the Bush-Cartesian paradigm in research universities, and it is not without importance that many of today's academic leaders began their university experience during this period.

5. Vietnam and Civil Rights

The Vietnam War brought an end to the Sputnik-stimulated increases in research funding, and to the corresponding growth in the research function of universities. Both the Vietnam War and the Civil Rights movement introduced massive civil disobedience into modern American society, and had the effect of changing authority relationships between students and faculty fundamentally. A "generation gap" sprang into existence reflecting the movement of the young away from many of the cultural and social values of their elders. Ethical issues moved to the fore for many Americans, with an emphasis not on the theoretical, but on the practical. In addition, the Civil Rights movement opened American universities to new groups of students, and new groups of faculty. This opening, combined with the general tenor of the times, led in turn to new academic disciplines that were more contextual than earlier Cartesian-influenced fields, e.g. Ethnic Studies and Women's Studies. In addition, some existing Cartesian areas spun off more contextually oriented offspring, such as environmental studies and ecology. Perhaps reflecting the newly recognized importance of some less Cartesian fields, the NEA and NEH were founded in 1965, and social science was officially added to the areas to be covered by the NSF in 1968. In the 1970's, this break with Cartesian, Modern traditions was reinforced in higher education through the introduction of Postmodern theories in the humanities and social sciences. These theories, identified originally with French authors such as Derrida and Foucault, challenged the fundamental tenets of Modernity. Among the tenets challenged was the Cartesian concept of, and ordering of,

hierarchies of knowledge.

6. The Reagan Presidency

The Reagan Presidency brought a new articulation of a more limited role for government, and a more market-economy focus. In particular, it marked a movement in government toward support for more narrowly defined research goals than had been proposed by Vannevar Bush. This change in direction was clearly revealed in the Strategic Defense Initiative (SDI), which was extremely well funded and highly technical in nature. However, unlike the situation that occurred following the launch of Sputnik, very little of this funding found its way to universities. The little that did was for very applied work. Thus for SDI, the Vannevar Bush principle that new excellent applied work would follow from additional excellent basic work was discarded, to be replaced by a narrower view in which the government was prepared to pay only for the "product" it needed. In addition, as opposed to the response to the Sputnik challenge, the SDI did not produce any increases in human capital through increased support of Ph.D. students. In this instance, at least, the government moved away from the Vannevar Bush principle that it was responsible for creating either the basic knowledge or the human components of scientific capital. More generally, during the Reagan years the government moved to make all funded university research more supportive of economic development. This new policy was felt even at the one government agency charged to support basic research, NSF, where increasing industrial competitiveness became the driver of increased funding.[7]

7. Funding for the Life Sciences and Engineering

Although not an "event" in the same sense as are the other items in this list, it is important to note the evolution in relative funding for these two areas over the past 40 years. Immediately after the end of World War II, government funding for basic research in universities strongly favored those areas that had been most influential in the war effort - the physical sciences (a very Cartesian, basic area of study).[8] Almost all of this funding went into schools of arts and sciences, thus propelling them to the forefront of research activity in the universities. However, university research in the life sciences began to grow after 1947 as extramural research funds were given to a revamped NIH, and several agencies began funding engineering research in universities

immediately after the war. In a strict Bushian sense, as mentioned above, research supported by NIH is not basic, since it is driven by very applied goals. Most viewers would readily concede that much of the research supported by NIH is quite fundamental, but there is a subtle but important distinction between basic and fundamental that will be important to consider below. Funding for basic research received a big push with the founding of the National Science Foundation in 1950. However, NIH funding for research at universities began the post-Sputnik era much larger than that of the NSF ($72 million, vs. $16 million at NSF) and remained larger even as NSF funding grew (for example, six years after Sputnik, in 1964, NIH-funded research at universities totaled $401 million, compared to $126 million in research funded by NSF).[9] Although some of this life sciences funding went into schools of arts and sciences, the majority of it went into medical schools. Indeed, by the end of the 20th century, in many universities, the medical school had more research funding than all of the other schools combined.

At the same time, research funding for engineering schools continued to grow, driven in large part by the mission agencies. In a final blow, in 1968 engineering research (all of which is applied by the Bush definition) was even incorporated into the mission of the NSF, which had been created to support only basic research. By the 1980's, engineering research grew into a principal focus of the NSF's funding. As a consequence, in the last 30 years, engineering funding has also passed the level of funding for the physical sciences.

These two events together reflected a massive shift in the focus of universities away from the Cartesian, Bushian core of basic research usually found in schools of arts and sciences, toward applied research found in professional schools.

8. Growth of the Knowledge Economy

The last decades of the 20th century saw a recognition that much of the world was moving into an economy in which wealth and economic power is produced not by natural resources, but by knowledge. This has greatly increased the value of a college degree. This increasing value has led to increasing debate regarding the goal of a college education - liberal or professional? Although that debate continues among educators, parents and government, students have increasingly demonstrated their priorities lie with the "professional." The percentage of students majoring in

the liberal arts has been dropping steadily since the 1970's.[10] This has led to a corresponding increase in the size and relative prestige of the professional schools. The growth of the knowledge economy has also greatly increased demand for elements of lifelong learning. Fulfilling this very pragmatic demand has enabled many professional schools at major universities to create new revenue streams and new relationships with the corporate world.

9. End of the Cold War

With the end of the Cold War, the rationale for much of government funding of research ended. The paradigms laid out by Vannevar Bush in Science the Endless Frontier had already been weakened by various events, as we have seen. The end of the Cold War led to a widespread conclusion among science policy analysts that the Bush rational was no longer useful in guiding government funding decisions. A wide ranging discussion was engaged to create a new support paradigm. Although the emerging paradigm does not have a single name associated with it, one of the most influential works in this discussion has been Donald Stokes' Pasteur's Quadrant.[11] Stokes argues that Bush was simply wrong in some of his definitions. In particular, Stokes argues that Bush's narrow definitions of basic and applied led to incorrect conclusions. In Stokes' view, basic and applied are not opposite ends of a one dimensional axis as Bush would imply. Rather, one should consider a two dimensional space in which one axis is the degree to which research is inspired by a quest for fundamental understanding, and the other axis is the degree to which the inspiration comes from considerations of use. In this space one quadrant (Pasteur's), indeed, involves research both inspired by a quest for fundamental understanding, and by considerations of use. The other quadrants of this space include one entirely devoted to applied work, without consideration of fundamental research, which Stokes called "Edison's Quadrant," and another entirely devoted to fundamental research, which Stokes attaches to Neils Bohr. One of the examples used by Stokes to characterize Pasteur's quadrant is the NIH. Focusing on that quadrant, Stokes argues that the universal and the applied can feed back on each other in a manner that empowers both. Thus the emerging paradigm rejects as misleading not only the V. Bush dichotomies, but also the Cartesian superiority of universal, decontextualized knowledge over contextualized, applied knowledge.

How, then, can we sum up the situation that faces us at present? At the beginning of the 21st century, the government seems largely to have given up on the basic vs applied paradigm, in favor of a new one which says that much (although certainly not all) of research can be simultaneously fundamental and useful. Within many areas of the university, we see that the Bush/Descartes paradigm that valued basic and universal over useful and contextual is losing its hold. For example, within schools of arts and sciences, the humanities and social sciences have seen the growth of a number of quite contextually oriented fields such as women's studies and ethnic studies, and postmodern concepts have had a major impact. Complexity, the bane of the Cartesian approach, is becoming a discipline itself. Over the past half century, government funding patterns have changed significantly the relative weights of schools of arts and sciences and certain professional schools that existed earlier. As a consequence, we find the reputation of many universities is now built not just on the quality of their basic, universal truth-seeking schools of arts and sciences, but also on the quality of their more contextual professional schools.

More fundamentally, however, many of the elements that enabled us to win the cold war, e.g. high technology (especially in communications), and open borders that enabled economies of the free world to flourish, have challenged our basic concepts of the appropriate role of the state.[12] It has become increasingly difficult for states to carry out their basic obligations to their citizens. For example, the state has increasing difficulty controlling its currency, its borders, its economy, or the flow of people and ideas. Because of their inability to control the most basic obligations of the state using traditional means, states have changed their approaches and roles. Many observers would suggest that an important component of the direction of this changing role has been to let the market play a much larger role in determining social investments. For example, James Duderstadt, President Emeritus of the University of Michigan, recently wrote:

> "It is important to remember that most of our institutions were the result of public policy and public investment through actions of governments at the national and regional level. Yet today, in the United States and many other nations, public leaders are increasingly discarding public policy in favor of market forces to determine priorities for social investment."[13]

One can see that this change "officially" went back to Reagan, but we have seen that for over 30 years the government has moved progressively towards a market position in research support. That is, one in which government increasingly viewed research support as a purchase of technical information needed to further some specific goal, rather than as a consequence of public policy aimed at creating educated researchers or new fundamental understanding for the long-term good of the nation. In this new market position, it is appropriate to create intellectual resources - both basic knowledge and educated researchers - in the course of doing the research the government wants to buy, but not for their own sake.

One also sees this market approach extending to other areas of importance to universities. For example, several bills currently before congress—such as the Affordability in Higher Education Act of 2003, introduced by Representative Howard McKeon of California—call for universities to lose student aid funds unless they meet certain standards with respect to tuition increases or outcome measures.[14] In a market-driven consumer society, one of the major roles of government is to assure that market conditions are defined in such a way as to minimize costs to the customer.

As Niels Bohr is said to have remarked, "prediction is difficult, especially if it is about the future."[15] However, it does seem that two old paradigms that were very important in the development of the research university are in the process of being swept away, to be replaced by two new ones. First, the Cartesian/Bush paradigm claiming incompatibility of basic and of applied research and describing the superiority of the universal over the contextual has been significantly weakened. Replacing it is a paradigm that might be called Stoksian, in which fundamental and applied research are not incompatible, and in fact, are so mutually beneficial (and often intertwined) that neither should be held to be of higher value. Second, the paradigm in which federal research funding is shaped by very broad societal policy goals is being replaced by one in which such funding increasingly is driven by market considerations. These considerations effect both the choices of areas to be supported (the government should not support what the private sector can do on its own), and the focus on supporting research and creation of infrastructure leading to answers to questions of interest to the government. This market view of the government is reflected in the

increasingly consumer-focused perspective of society.

Of course, in addition to conditions that have led to the long-term paradigm changes discussed above, other elements of the environment have changed, and new and unexpected changes will continue to appear. For example, the Cold War has been replaced by a War on Terrorism. This new war calls into question our assumptions about the pace and future of globalization, and could dramatically curtail access to our institutions by international students. In addition, our national responses to this new threat risk to curtail the free flow of ideas, perhaps leading to restrictions on open publication of non-secret research results.

As we begin to think about the university of the future, it is important to question what these changing paradigms and changing environment might mean for us. On the one hand, many of our faculty have been thriving precisely because of these paradigm shifts for considerable time now, and may wonder why one should make a point of what to them is obvious. However, by recognizing the magnitude and breadth of the shifts, we can begin to pose larger, more global questions. What does this mean for the traditional disciplines, or for graduate education, or for the relationships between professional schools and the College? What impact will changing societal expectations have on student interests, government regulation of higher education, industry relationships? What should we expect our students of the future to be in terms of age, previous education, location? How will technological advances and changes in expectations alter the ways in which we teach those students? What will be the impact of for-profit education on our various schools and disciplines? We must answer questions such as these if we are to seize the opportunities presented by the evolving environment in order to make USC a leader in the creation of the 21st century university.

[1] Roger Geiger, "Research, Graduate Education and the Ecology of American Universities: An Interpretive History," in Sheldon Rothblatt and Bjorn Wittrock, eds., *The European and American University since 1800: Historical and Sociological Essays.* (Cambridge, UK: Cambridge University Press, 1993), 273-288.

[2] Stephen Toulmin, *Cosmopolis: the Hidden Agenda of Modernity* (Chicago: University of Chicago Press, 1992).

[3] Harland G. Bloland, Journal of Higher Education, 66,521 1995

[4] Vannevar Bush, *Science: The Endless Frontier, A Report to the President by Vannevar Bush, Director of the Office of Scientific Research and Development, July 1945* (Washington: United States Government Printing Office, 1945).

[5] Ibid., 16.

[6] Roger Geiger, *Research and Relevant Knowledge: American Research Universities since World War II* (New York: Oxford University Press, 1993) 186.

[7] Ibid., 308.

[8] Ibid., 33.

[9] Ibid., 186.

[10] U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey (HEGIS), *Bachelor's degrees conferred by degree-granting institutions, by discipline division: 1970-71 to 1999-2000*, Washington, D.C., 2001.

[11] Donald Stokes, *Pasteur's Quadrant: Basic Science and Technological Innovation* (Washington, D.C.: The Brookings Institutions, 1997).

[12] Philip Bobbitt, *The Shield of Achilles: War, Peace, and the Course of History* (New York: Knopf, 2002).

[13] James Duderstadt, "The Future of Higher Education in the Knowledge-Driven, Global Economy of the 21st Century" (paper presented at the 175th Anniversary Symposium, University of Toronto, October 31, 2002).

[14] *The Chronicle of Higher Education*, 11 July 2003, B20.

[15] As quoted on www.quotationspage.com