KEYNOTE ADDRESS

CLUSTERS AND COLLABORATIONS

IN THE NEW RESEARCH ECONOMY—

CREATING STRATEGIC INTENT AMONG UNIVERSITIES

Luis M. Proenza
President
University of Akron

That we live in interesting times is the understatement of our modern age. “Seismic rumbles of change,” to use Chuck Vest’s phrase, are plunging research universities into crosscurrents and rapids that already are transforming traditional paradigms for research and graduate education—to say nothing about the relationships between academia, industry, and government.

The sources of cataclysmic pressure are many and include:

- competition among our own universities;
- shifting demographics and their accompanying shifts in national priorities;
- resource constraints; and
- public scrutiny of productivity and accountability in our universities.

Of major concern is the absence of a powerful national driver for Research & Development (R&D) now that the Cold War is over.

Amidst these forces of change, as Eric Bloch suggested, we scientists seem to have embroiled ourselves in a climate of pessimism, a sort of scientific “mid-life crisis,” because 50 years of doing research one way has fostered the belief that it cannot be done another way.

Somehow, the prospect of change always seems to raise a sense of excitement and, simultaneously, a sense of risk.

For some, risk becomes a sense of anxiety. And quite often, particularly in academic and political circles, anxiety leads to “analysis paralysis.” But remember that risk and anxiety are two quite different conditions. A simple story will illustrate the point:

The Surgeon General tells us that cigarettes kill more than 150,000 Americans each year, and that automobiles on our highways kill more than 50,000 people per year. But, nobody seems to be afraid of cigarettes, nor of automobiles. However, according to the Deputy Director of the National Institutes of Health, everyone is afraid of sharks. The Navy says that there are about 50 shark attacks worldwide each year.

The National Bureau of Health Statistics doesn't even keep a record of shark attacks because there are so few. (They know how many people are killed by bee stings, but not shark bites.) The best guess is that sharks kill two or three people each year in the United States. But, the fact is that if you went to a crowded beach and shouted "shark" —everyone would race out of the water, jump into a car, light up a cigarette, and drive home! That's the difference between anxiety and risk. Each of us feels this way about various things and about some activities in our society.

How nice it would be if we could put risk and anxiety into perspective, and move to better distinguish the “sharks” in our midst. Indeed, where reason and calm prevail, there is always optimism, and much that can be accomplished for the common good.

And so, in this reasonable and calm gathering, it is appropriate that we revisit the closing theme of Michael Crow's keynote address to this conference last summer: "How do you <u>think</u> about organizing collectively?"

You may recall that Dr. Crow had elaborated six questions that we might ask to help us think about organizing collectively, and I will echo many of his themes, but for our discussion this morning, I would like to rephrase his general question slightly and ask more practically: How do we <u>go</u> about organizing collectively? How do we organize to enhance and optimize research competitiveness in this Age of Global Change?

To provide an answer to this question requires that we understand the R&D environment, that we know our competition, and ourselves and that we have a sense of what we want to do. Thus, this morning I will develop these three themes:

First, I want to characterize the research economy by outlining the principal features of the U.S. R&D environment, particularly its economic and sociopolitical aspects—to do, if you will, an “environmental scan” on today’s economic and sociopolitical drivers.

Second, I want to discuss academic research competitiveness in terms of some simple analyses of relative growth among institutions and of

their differentiating research portfolios. In other words, I will suggest some simple metrics needed to determine where our strengths and opportunities might lie.

Finally, I want to focus attention on some strategic questions and possible approaches and to talk about competitiveness and collaboration as necessary and complementary elements of an approach I shall call "strategic intent."

Let me thus begin with some comments on the R&D environment. The first thing to be said is that the environment for R&D is a complex and interactive one. It is shaped not only by the quantity and sources of funds available to support research activities, but also by the talent pool and capabilities of the scientists and engineers who conduct research, and by the settings in which that research is conducted, that is, by its "infrastructure"—in the sense of its facilities, its institutional culture, and those other related attributes governed by geographical location and interrelating organizations and facilities, many of which are increasingly global and without boundaries!

The R&D environment also is shaped by prevailing public attitudes about the importance and usefulness of research in the broader context of societal pressures and economic opportunity.

Let's talk first about the size and shape of the research economy itself—the research marketplace, if you will. Worldwide, R&D is a $410 billion industry, of which 90% is dominated by just seven countries, and 44% by the U.S. alone, which accounts for approximately $180 billion. Of this $180 billion in U.S. R&D expenditures—60% is derived from industry, 36% from the federal government and 6% from foundations, states and our own research universities. Within the U.S. research economy, academic performers garnered about $23.8 billion, or 13% of the U.S. total, in 1997.

This 13% academic “market share” is, of course, distributed among an increasingly larger number of our nation’s 3,611 colleges and universities. Just after World War II, fewer than 50 universities performed sponsored research. By 1980, the number had risen to 600 institutions, and, by 1995, to 875 colleges and universities.

If the truth be told, the bulk of America’s research universities are post-World War II phenomena; many have emerged in just the last three decades. And as Michael Crow said last year, there is no single model or form of what a research university is—perhaps much to the chagrin of the Association of American Universities (AAU). If the truth be known, had any of us been approached by most of today’s research universities during the first half of

this century, most of us would have considered their job offers demeaning and well beneath our aspirations.

As you know, marked imbalances exist both geographically and among universities in the distribution of R&D wealth. Moreover, there continues to be a press for expansion and dispersion, as seen in the aspiration of so many institutions wishing to be designated as Research I or Research II universities in the Carnegie Classification.

I would argue, however, that the Carnegie Classification is not particularly meaningful, since total federal obligations need not reflect much about research strengths. I know of one university, for example, classified as Research II, whose total federal obligations are $35 million, but only $4 million of those $35 million are for R&D—the rest coming from the United States Department of Education.

In contrast, take the case of my good university, the University of Akron—which perhaps most of you do not even know—and which currently is not listed as a Carnegie Research II institution. Perhaps that is because the University of Akron is characteristically atypical among research universities. It has several nationally ranked programs (one of which is rated second in the nation, ahead of California Technical and MIT), but in contrast to most other so-called research universities, it derives 75% of its research support from industry. Remember, there is no single model for a research university

Parenthetically, for those of you interested in the evolution of research universities, I recommend you study Roger Geiger's historical analysis in his 1993 book, *Research and Relevant Knowledge: American Research Universities Since World War II*. I particularly recommend his splendid vignettes on the development of selected research universities.

A newer book—*The Rise of American Research Universities: Elites and Challengers in the Postwar Era*, by Hugh Davis Graham and Nancy Diamond—also provides an historical analysis together with quantitative comparisons to identify 50 leading research universities as of 1990. Their list includes 32 "rising" institutions that previously were not highly ranked in national surveys. And, it excludes a dozen institutions holding membership in the elite Association of American Universities.

These are "seismic rumbles of change" indeed!

But to return to the matter of R&D market share, obviously, academic institutions do not have a particularly notable share of this market—only 13%. The bottom line question is this: Can we afford to ignore 87% of the market? I

think not! And, considering the growing international dimensions of R&D, the opportunities to gain market share by “going global” are even larger! If we follow the money, we find that universities are missing out on nearly $160 billion in the U.S. R&D economy alone, and on $250 billion in the world R&D economy.

Now that we have had a glimpse of the R&D marketplace, let us continue with the environmental scan by turning to public attitudes, and particularly to those displayed in federal and state political arenas. Some highlights will suffice:

At the federal level, the growing tension between the budget deficit and discretionary spending priorities has, until recently, dominated the political landscape. Even with the new "politics of prosperity" that has been fueled by growing surpluses, the research "slice" of the budgetary "pie" is still small and threatened by pressures from other segments of the federal budget. What with the discretionary portion of the federal budget now at 32%, and nearly half of that going to defense—and with entitlements and mandatory programs now at 68% and climbing—you can bet that something has to give!

Federal agencies also are signaling changes. I am sure I need not tell this audience of the emphasis now being placed on multi-disciplinary and large center programs, or of the pressure for cooperative agreements with industry, or for that matter, of the growing trend to increase academic productivity by better integrating research and education.

In our states, legislatures have been increasingly less willing to support higher education, at least as evidenced by the decreasing share of state budgets going to academe. Competing pressures from other state priorities have also made themselves felt, where today, for example, prisons and corrections constitute the fastest growing part of state budgets. When it comes to research, most states lack a framework for considering R&D activities, or for integrating R&D at the state level with programs at the federal level.

What is more, with a booming economy, workforce development is today the #1 issue in corporate America. Public expectations in regard to the training of our research professionals are also changing. With the majority of Ph.D.’s now taking jobs in industry, we are having to rethink graduate education. Employers, both academic and industrial, are demanding new skills. I am sure you have heard the litany: They want problem solving skills, communications and interpersonal skills, team building and leadership skills, among others . . . and, in this competitive and fast-paced environment, one industrial recruiter recently asked for "emotional resiliency," as well.

Undeniably, we do live in interesting times, amidst a complex and dynamically changing environment for R&D. "And inherent in change, as it always has been, is opportunity. And, of course, risk" (Merrill Lynch & Co., Inc., 1990). Risk and opportunity are inseparable. And both are best managed by an informed perspective, which is precisely the point of the second part of my remarks, so let us turn to the topic of what we need to know.

In the simplest of terms, if we are to respond to the "seismic rumbles of change" in the R&D marketplace, it helps if we know ourselves; if we know our competition; if we know how to leverage; and if we know how to try new things on for size!

In this regard, let me state categorically that there is no "adequate" measure of research competitiveness or of university strengths—none! All are flawed and caveats abound. Each of our institutions is either first or last on some measure; it all depends on how you frame the questions!

While various approaches have been tried, and there is a whole literature on this subject, none is more commonly used than the "rankings" provided annually by the National Science Foundation based on research expenditures. However, one must be careful not to use total expenditures or total obligations, but rather to focus on federal obligations for R&D, because it is federal obligations for R&D that comes closest to demonstrating competitiveness.

For the period 1976 to 1994, an 18-year time window, federal obligations for academic research grew by 384%, or 90% above inflation. In effect, the pool of dollars available to universities grew by 384%. During that period, among public research universities, one university grew by only 100%, while many others enjoyed increases well above the average of 382% for public institutions. The prize goes to one university that grew by 2000%! How did each of your institutions fare?

This simple "percent growth" approach helps us understand how we all fared comparatively and in relation to the "absolute" benchmark of overall increases in federal obligations. Yet, to examine differential competitive strengths, we must also look in more detail and examine what our research portfolio looks like. So, for example, in regard to the federal support of research, the portfolio question is to know the relative shares of support from each federal agency.

Within the spectrum of federal agencies, six agencies (of the 13 that support academic R&D) account for 96% of all federal funding. These are:

- Department of Agriculture, with 3% of the total;
- Department of Energy, at 5%;
- NASA, 6%;
- Department of Defense, 14%;
- National Science Foundation, 15%;
- National Institutes of Health, 57%.

Few campuses approach the "average" distribution of available federal funds. Looking at your portfolio will tell you something about your relative strengths in those areas currently supported by the federal government.

An even more penetrating analysis is to determine how your portfolio shares have changed over time, and how they are changing dynamically today. That is because growth in agency budgets has not occurred uniformly across agencies or over time, and because one must examine strengths at the micro level as well. For example, funding from NASA peaked right after Sputnik; Department of Energy funding after the energy crisis of the late 1970's; and Department of Defense funding was maximized in the Cold War period. Over this same time period, new programs were put into place as new needs were identified and new research findings suggested new opportunities.

How did your campus fare in specific areas of research? This is a further extension of the portfolio approach. In business, it has become important to think of industrial clusters as meaningful ways to look at state economic strengths, and the Council on Competitiveness has suggested that today, "clusters of innovation" are the harbingers of tomorrow's new industries. So where are your institution's strengths, its "clusters of opportunity" if you will?

One approach may be to examine clusters of strength by the approach used by the Institute for Scientific Information some years ago. ISI, by finding an emerging pattern of citations (clusters of citations), was able to "discover" the new field of immunology before it was so labeled. Thus, if you know how your own clusters are constituted, and you explore what research groups your colleagues are linked to, you can begin to discern a pattern of possible collaborations.

In trying to increase your market share in R&D, these types of data <u>are</u> strategic. You must have such analyses if you are to craft an appropriate strategy for your university. Indeed, such strategic information provides the

context in which you can assess your core activities and emerging opportunities.

Again, do remember that there is no single model or form for a research university. In research, as in business, you cannot be all things to all people, and comparative and competitive advantage requires focus and direction.

What are we to make of all of this in a practical sense? How might you want to approach this dynamic environment at your own institutions now, today! Where are the opportunities? And how might you shape your vision and your strategy? These questions bring us to the third and final segment of my remarks, namely some practical considerations and ideas.

As we begin to explore how one does it, it may be helpful for me to remind you that all of you are really venture capitalists—venture capitalists of the academy. Your decisions are the basis for whether or not your universities earn a return on investment. Think about it!

Although we do have a complex and shifting R&D environment, all of the indicators that I see on the horizon make me optimistic about the future of academic R&D, but not necessarily as we now know it.

First, as I have already suggested, we have a significant opportunity to gain market share. We cannot ignore 87% of the U.S. R&D market, nor the even larger global marketplace for research. For example, organizing for global grants and contracts competition has long been the hallmark of MUCIA, the Midwestern Universities Consortium for International Activities.

Second, opportunity also exists in the very business that we are in, mainly education, if looked at from a research perspective. Educational R&D is an infinitesimally small fraction of educational expenditures, and we have not advanced the science of education nearly enough. Clearly, with Kindergarten through 12th grade education still under attack (reference Nation at Risk, 1983) and in need of reform, you can well imagine the power of any knowledge that can demonstrate what actually works in education! You can bet that this will be a huge opportunity.

Third, other opportunities abound because just as there is no single model or form that defines a research university, so also is there no single approach to gaining research strength. I believe there are opportunities for universities to create greater differentiation among themselves, either as individual institutions or through creative alliances that shape new dimensions of competitive and comparative advantages. Focus and differentiation are

respected elements of competitive strategy, and no university can afford to be truly comprehensive in today's environment.

Fourth, with so many performers of R&D, we should not be afraid to ask what will be the academic equivalent of mergers and acquisitions, of managed health care plans, and of the emerging private practice corporations? What new and innovative forms of outsourcing will be considered? What alliances and coalitions will emerge to consolidate and expand market share? And what comparative and competitive advantages will be expressed as the new generation of research universities emerges in the years ahead, as indeed it surely will?

I suggest that key among the issues that will drive such radical change is the concept of "strategic intent."

In their provocative book, *Competing for the Future*, Gary Hamel and C.K. Prahalad define "strategic intent" as "an ambitious and compelling . . . dream that energizes a company . . . that provides the emotional and intellectual energy for the journey . . . to the future." Thus, "strategic intent" conveys "a sense of direction . . . a sense of discovery . . . (and) a sense of destiny. . . . It implies a significant *stretch* for the organization."

In short, strategic intent asks you to state what it is that you want to be, and it insists that you do so in powerful and ambitious terms! It is a form of the old question: "What do you want to be when you grow up?" And so I would ask, what do you want your university to be when it grows up?

The alternatives are many. You can emulate Harvard or MIT among private universities, or maybe you want to be more like Michigan or Purdue. Or maybe you want to consider how you can best be yourself, rather than like any of the better-known universities, since there is no single model to define a research university.

Please do imagine how much more varied and numerous our alternatives can be, particularly when we expand our thinking to include the possibility of creative collaborations—both among universities and with the private sector and government.

The Council on Competitiveness, in its 1996 report, "Endless Frontier, Limited Resources: U.S. R&D Policy for Competitiveness" had this to say: "Over the next several years, participants in the U.S. R&D enterprise will have to continue experimenting with different types of partnerships to respond to the economic constraints, competitive pressures and technological demands that are forcing adjustment across the board. . . .The innovative responses to

these constraints, pressures and demands include—closer working relationships between research universities and industry, increased interaction between industry and the federal R&D establishment, and company-to-company R&D alliances among domestic competitors, suppliers and even foreign rivals."

Of course, in recent years, perhaps the most interesting partnerships involve the so-called "virtual universities." I will not dwell on them here, but suffice it to say that they merit close observation.

Another form of collaborative innovation involves mergers, which would at first seem like anathema in most large and well-established universities. But the idea of mergers in higher education is not new.

In the first half of the century, many small normal schools became parts of larger universities—and, sometime later, a similar movement occurred in regard to small law schools. In my neck of the woods, both the Akron Normal School and the Akron Law School became colleges within The University of Akron.

In the second half of this century, hundreds of institutions of higher education created consortia or opted to merge. Carnegie Tech and the Mellon Institute joined to become Carnegie Mellon University, Western Reserve University and the Case Institute combined to form Case Western Reserve University, and many such mergers have continued both here and abroad. For example, in 1986, Tift College merged with Mercer University. Here in Kansas, Kansas State University and the Salina Technical Institute merged in 1991. And just this year, venerable Radcliffe College merged with Harvard University.

That mergers are not so uncommon in higher education is evidenced by a whole literature on the subject and, testifying to the maturity of the subject, there is now even a handbook on academic mergers published just five years ago. The authors of this handbook, James Martin and James Samels, state that " . . . mergers at the collegiate level have become one of the most creative, effective vehicles academic planners now have to achieve academic excellence, to articulate a broader institutional vision, and to solidify the strategic position of the combined institution locally and regionally" (*Merging Colleges for Mutual Growth: A New Strategy for Academic Managers*, Johns Hopkins University Press, 1994, p. 3).

The book even provides a typology of higher education mergers, enumerating the following among the principal types:

- pure merger
- consolidation
- transfer of assets
- consortium
- federation
- association
- joint venture
- affiliation

If true mergers perhaps figure in the many hundreds, other forms of collaborations are in the thousands. In looking at consortia, for example, one would do well to start with the unusual model pioneered by Indiana and Purdue, which dates back to the late 1960's.

By that time, both the Indianapolis-based programs of both Indiana University in medicine and Purdue University in engineering were well established. Yet, the leaders of both universities and the state government collaborated to blend those and other programs into a single, new university campus. Since 1969, Indiana University-Purdue University Indianapolis (IUPUI) has doubled in size and built an increasingly stronger reputation. A comparable approach was also developed for the Fort Wayne campuses of Indiana and Purdue.

In 1972, a consortium of universities in Northeast Ohio—University of Akron, Kent State and Youngstown State—worked with 16 area hospitals to develop a plan to strengthen medical education in the region. B.S./M.D. programs were established on each university campus, and the Northeastern Ohio Universities College of Medicine was opened in a central location in 1975. The College now graduates more than 100 physicians each year.

In Massachusetts, five institutions created consortia through which students from any one of the colleges may enroll in courses at the other schools at no extra charge. Members of the Five Colleges Consortium are the University of Massachusetts, Amherst College, Hampshire College, Mount Holyoke College and Smith College.

The same, simple idea of resource sharing applies on an even larger scale. For example, the chief academic officers from the eleven "Big 10" universities plus the University of Chicago form the Committee for Institutional Cooperation, or C.I.C., which has provided a steady spirit of cooperation among otherwise competitive universities since its start more than 40 years ago.

From its inception, the C.I.C. has been governed by three principles:

- "that no single institution can or should attempt to be all things to all people;
- that inter-institutional cooperation permits educational experimentation and progress on a scale beyond the capability of any single institution acting alone;
- that voluntary cooperation fosters effective, concerted action while preserving institutional autonomy and diversity."

The joint efforts of the C.I.C. universities have complemented and augmented institutional programs in most aspects of university activity outside of intercollegiate athletics (which is undertaken by the Big 10 Conference). Through four decades of change, the collaborative approach of the C.I.C. has succeeded in situations in which competition alone may have been counterproductive.

Their Virtual Electronic Library offers a single interface to search all member library catalogs and to allow users to request items from any of the libraries. Recently, the C.I.C. libraries have joined in an aggressive effort to acquire electronic information resources through group licensing, saving more than $7 million in the first four years of the program.

The list of C.I.C. accomplishments goes on and on to include a pioneering regional computer network, the Summer Research Opportunities Program for talented undergraduate minority students, the Academic Leadership Program for administrators, the Minority Fellows Program, and the Women in Science and Engineering Program.

Let us remember, however, that joint efforts need not be restricted to collaboration within and among universities. For example, while I was at the University of Georgia in the mid-1980's, we developed a program which coupled the exceptional plant molecular biology strengths of the University of Georgia with the world renown summer studies program of the Marine Biological Laboratory at Woods Hole. The then MBL president, Paul Gross, and I agreed to advertise the program jointly under the banners of the two institutions—a "win-win" approach because each gained something from the other.

The new research economy also requires increased university-industry cooperation. A prime example is the type of strategic partnership, which we developed at Purdue with Caterpillar.

The essence of the partnership is simple:

- Purdue and Caterpillar have an overarching, master agreement that allows them to avoid negotiating individual projects each time one is begun;
- They sign confidentiality agreements on both sides and protect the academic right to publish;
- High-level personnel from both institutions participate, and personnel are exchanged;
- And, most important, trust is built through mutual benefit from synergistic efforts.

Of course, students are involved in every aspect of the partnership—gaining practical experience in a dynamic industry and having the opportunity for substantive job placements upon graduation. Such collaborations are critical not only to the prosperity of higher education in America but also to the ongoing economic competitiveness of the United States.

Indeed, according to one of the most recent reports from the Council on Competitiveness, "Future U.S. competitiveness will hinge not just on policies and investments at the national level, but on the capacity to foster clusters of innovation in regions across the country."

This theme is echoed in the May 31st, 1999 issue of *Forbes* magazine, where Tim Ferguson writes, "In the new economy, a cluster is made out of brainpower . . . a critical mass of skilled workers, established employers, and entrepreneurs in vital sections of the economy." In the old economy, he states, " . . . proximity to water or rail mattered a lot. Today, proximity to a university campus matters a lot."

Clearly, research universities can be expected to lead these clustering efforts. This was precisely the conclusion of the Indianapolis and Central Indiana High Technology Task Force, on which I had the privilege of serving, when it examined the development of successful technology clusters nationwide. The task force's 1998 report cited university involvement as key to the success of new technology development.

Other examples come to mind from Austin, Research Triangle Park, and Utah—about which Robert Barnhill will have more to say later. Still, even as fast moving and dynamic as technology itself may be, it is well to remember that the establishment of these technology clusters takes time.

Georgia's positioning as the economic heart of the "New South," for example, began in the late 1960's, when Governor Busbee made the unprecedented decision to add 400 faculty positions at just one university. After that early period of basic investment, Governor Harris in 1984 provided strong leadership and initial investments in R&D through what was later, under Governor Miller, to become the Georgia Research Alliance. The Alliance is credited with increasing research sponsorship at Georgia's universities significantly. Between 1990 and 1997, sponsored research at Georgia's universities went from $400 million to more than $700 million.

The Alliance also helped to:

- attract 22 eminent scholars from throughout the world to Georgia;
- accelerate growth in intellectual properties licensed from the university sector to private enterprise;
- encourage business-friendly technology transfer systems such as that of Emory University. Emory grants faculty members leaves of absence of up to one year to participate in a start-up business.

Across the nation, many other states have lagged in innovation and lost market share in R&D. Yet, one of the most encouraging signs that I see on the horizon is that some states, perhaps, are showing signs of competitive awakening, as they increasingly recognize the role of university research in economic vitality.

This year, Indiana created a 21st Century Research and Technology Fund and is prepared to spend $50 million per year in areas of strategic opportunity. Two years ago, Illinois established funding mechanisms to enhance university-based R&D. Just last week, Governor Engler in Michigan announced a $1 billion plan to create a life science research and industrial corridor over the next 20 years.

In Ohio, Governor Bob Taft has called for the state to invest in its future and to become a leader in science and technology. An early success is this year's appropriation of $30 million ($15 million in each year of the biennium) for science and technology programs recommended by the Governor's science advisor.

I could go on and tell you about many other examples or about how we are crafting the future of the University of Akron, but perhaps those that I have cited will have already provided enough fertile ground for our discussion. Suffice it to say, then, that we could all learn from many of these approaches. And, indeed, we must if we are to prosper in this fast-changing research economy.

If and when we do, then even amidst seismic rumbles of change we might come to glimpse the new landscape and new structures of emerging opportunities. We might even craft strategic intent!

I leave you with just one thought: Be cheerful, and plunge ahead!