Luis M. Proenza

Relevance, Connectivity, and Productivity

Three Paths to Innovation in Higher Education

"Seismic rumbles of change" are currently plunging universities and industries into cross-currents that are transforming traditional paradigms for research and higher education—not to mention the relationships among academia, industry, government, and the public.[1] In this challenging context, it is intriguing to contemplate how innovation will change the nature of U.S. higher education.

Indeed, we should not be afraid to ask what the academic equivalent will be 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? What comparative and competitive advantages will be expressed as a new generation of research universities emerges in the years ahead?[2]

Despite the fact that research universities have continued to evolve in many significant ways (as documented, for example, by Roger Geiger[3] and Graham and Diamond[4]), they now face a time of great challenge and opportunity. Vast innovations are underway in higher education around the world. This essay examines the innovation framework at The University of Akron, which focuses on three strategic areas: relevance, connectivity, and productivity.

RELEVANCE

Sadly, the word "academic" has become a synonym for "irrelevant," as in the statement, "That is academic!"—a prevalent pejorative attitude that universities must overcome if they are to be economically viable in the future. Indeed, U.S. Senator Lamar Alexander recently said, "As with the auto industry in the 1960s, there are signs of peril within American higher education. . . . In some ways, many colleges

Luis M. Proenza is President of The University of Akron and a national leader in science and technology policy. Prior to joining Akron, Proenza was Vice President for Research and Dean of the Graduate School at Purdue University and, previously, Vice President for Academic Affairs and Research at the University of Alaska.

This article is based on a paper presented at the Beijing Forum, in Beijing, China, on November 8, 2009.

and universities are stuck in the past [and will need new] . . . innovations [to] stay competitive and relevant."[5] E. Gordon Gee, president of The Ohio State University, told the American Council on Education, "At this defining moment—when our communities and our nation need us more than ever—we must fundamentally reinvent our institutions. We must become more agile, more responsive, less insular and less bureaucratic. In so doing, we will save ourselves from slouching into irrelevance."[6] While these opinions echo popular sentiment, we must examine how history shaped academic relevance and how we might yet regain it in the 21st century.[7]

To sustain their economic viability, universities must demonstrate their relevance by delivering real benefits to their communities.

Probably the strongest statement ever made about academic relevance was the Morrill Act of 1862, which called upon land-grant universities to focus on agriculture and the mechanical arts to advance the public good. With powerfully relevant research in the years succeeding the Morrill Act, those new American universities transformed agricultural productivity and the very nature of industry.

Ironically, even with those major contributions, the land-grant model never fully transferred to academic pursuits outside of agriculture and engineering. Instead, other academic disciplines remained largely cloistered and isolated within the "ivory tower." The complexities of the 21st-century knowledge economy, however, now demand that every academic discipline be engaged with the relevant questions of the day and work in concert with other disciplines and partners, on and off campus. Relevance requires the integrated application of all disciplinary knowledge for the public good, and universities must find ways to facilitate engagement across the full spectrum of disciplines.

Clearly, to sustain their economic viability, universities must demonstrate their relevance by delivering real benefits to their communities. In doing so, there are many opportunities for innovation, since universities increasingly are serving as "anchor institutions" [8] and "foundational institutions,"[9] whose competitive and comparative advantages are inextricably linked to the vitality and sustainability of their surrounding communities. In this regard, some universities are deploying broad and robust "tool chests" with which they create economic value. Still, there is one major gap that must be bridged: namely, finding what actually works in education. The science of education has not advanced nearly enough for educators to practice evidence-based education. This is not surprising, given the fact that educational research and development (R&D) is an infinitesimally small fraction of educational expenditures.[10] Yet, if universities are to further their relevance, they must demonstrate the effectiveness of education itself.

CONNECTIVITY

Relevance is expressed when universities connect and engage with partners without institutional, sector, disciplinary, or geographical constraints. When governments reduce financial support, such connectivity becomes a necessary innovation strategy because universities are forced to generate new revenues from whatever other sources they can. Thus, universities now are being called upon to explore innovative partnerships and to create campus cultures congruent with new realities that require close and deep collaboration with other public- and private-sector organizations. They must also express a willingness to experiment with new models and new alliances. As universities work increasingly with new kinds of partners, core academic processes are challenged, and speed and adaptability must be integrated into the academic culture.[11] Connectivity of this sort can be understood in the context of an "innovation ecosystem" and two of its components: the R&D marketplace and the supply chain of human talent.[12]

THE INNOVATION ECOSYSTEM

This is the system of loosely interconnected elements that enables us to make discoveries, capture their value in the marketplace, enhance productivity, and increase our standard and quality of living.

The innovation ecosystem is complex and interactive. It is impacted by regulatory and support environments, which in turn interact with financial opportunities and challenges across the world. It is shaped by the quantity and sources of funds for research, the availability and capabilities of research scientists and engineers, the settings for research, and prevailing public attitudes about the importance and usefulness of research in the broader context of societal pressures and economic opportunity.

A shortcoming or disconnection involving any piece of the innovation ecosystem is at best inefficient and at worst a detriment to commercialization and economic growth. Thus, enhancing connectivity helps to optimize the innovation ecosystem, and this is perhaps most readily illustrated by studying the funding patterns and currency flows associated with R&D. We are witnessing several ways in which the globalization of markets is affecting how science is both funded and practiced. For example, the more rapid pace at which new discoveries are quantified in the asset ledgers of corporations ensures that investment funds increasingly track the flows of intellectual property developments around the world, and further demonstrates the growing interdependencies of the science and technology activities of nations.

GLOBAL PATTERNS OF R&D SUPPORT[13]

Today's global economy is an innovation economy, driven by the discovery and application of new knowledge that emerges from R&D. Globally, the R&D marketplace now exceeds $1.1 trillion, a sizable industry by any standard.

Of course, R&D is not evenly distributed across the world. Just ten countries perform nearly 80 percent of global R&D; the U.S. is the dominant performer at $398 billion or 33 percent of the total. Within the U.S., 67 percent ($268 billion) is funded by industry, 26 percent ($104 billion) by the federal government, and 7 percent ($26 billion) by foundations, states, and research universities.

Colleges and universities perform about $51 billion in R&D. Nearly 60 percent ($30.2 billion) comes from the federal government; 35 percent ($18 billion) from foundations, states, and universities themselves; and 5 percent ($2.9 billion) from industry. At 13 percent of the U.S. total, academic institutions obviously do not have a particularly notable share of the R&D market, so clearly there are opportunities to enhance innovation by improving the connectivity ratios among funding sources and performers, and also by expanding international connections so as to access global R&D resources. One of the most glaring disconnections is the very small fraction of university research that is funded by industry (5 percent)—a marked imbalance that suggests enormous room for growth and a necessary next step in enhancing the innovation ecosystem. This disjunction also likely explains some of the acrimony presently affecting some aspects of university-industry relationships.

THE TALENT SUPPLY CHAIN: AN INVESTMENT OPPORTUNITY?

Productively connecting human capital to the economy is essential to the effectiveness of the innovation ecosystem. Therefore, a serious academic approach to the concept of talent supply chain management is needed, and given that the economic impact of human capital is presumed to be quite large, this endeavor could facilitate the formulation of new tools to quantify the worth and investment value of intangibles in the economy. For example, could a tradable security be devised that captures the public returns on investment (ROI) produced by higher education?

Some economists have argued that national economic indicators presently in use do not value intangibles, such as human capital or intellectual property. For example, *BusinessWeek* writer Michael Mandel noted that the Bureau of Economic Analysis in Washington has "no way of tracking the billions of dollars companies spend each year on innovation and product design, brand-building, employee training, or any of the other intangible investments required to compete in today's global economy." Acknowledging that "it's a lot easier counting how many widgets the nation produces in a year than quantifying the creation and marketing of knowledge," Mandel argued that measuring intangibles such as brand equity, the development of talent, and the export of best practices is critical to understanding our knowledge-based economy. "This stuff is hard to measure, but to ignore it is to miss what the economy is telling us," Mandel said. It follows, then, that markets are needed that value intangibles and seek efficient approaches to building human capital.[14]

One way to begin would be to use supply chain management concepts to analyze the links in the human capital pipeline and to determine how these links can

be optimized. Industry has derived significant economic gains by relentlessly focusing on and refining its materials and component supply chains. Tremendous improvements have been made in managing time, raw materials, quality, price, and performance, so it is likely that business has squeezed almost every ounce of efficiency possible out of such inputs. Yet, although everyone in business says that their most important challenge is to build a skilled workforce, few companies have sought to manage their talent pipeline with a supply chain–like discipline.

Consider this: It is estimated that 95 percent of all technology transfer happens when people move from one place to another—that is, when the "material" of human capital arrives at a company. It is further estimated that companies spend an average of $1,000 per year per person to enhance the skills of their workers, even though the estimated return on investment is 25-fold. So, what would happen if industry gave as much attention to the human capital side of their supply chain? Companies could save substantial time and money by taking a more proactive approach to talent acquisition, for example, by forecasting demand for human capital and even matching up that capital with specific jobs. What would happen if companies started to expect colleges and universities to create a supply chain of human capital? By bringing the job market into consideration, we can seek to reduce disconnections, to monetize the movement from education into the workforce, and, by better quantifying the social ROI, also seek to monetize the role of government. Indeed, universities should undertake a rigorous academic approach to management of the talent supply chain.

PRODUCTIVITY

While many industries—for example, agriculture and manufacturing—have seen enormous growth through productivity, there are large sectors of the global economy—health care and education, for example—that have yet to see major changes in productivity, which they must do so as not to consume increasingly larger, and thus unsustainable, fractions of our economic resources.

The astounding rate of increased productivity in information technology, as exemplified by Moore's Law, often has led to artful analogies by constructing "what if" scenarios of other industries, asking, for example, what would have happened if that industry had changed as much and as fast as the power and cost of computers. This has been done for the airplane,[15] the automobile,[16] and even for education. So, what if education also had advanced as far and as fast as the computer? The computer analogy suggests that "[a U.S.] high school or college education—which still takes twelve and four years, respectively, to complete at an average cost for either of about $60,000—could today be completed in less than 10 minutes for about 5 cents!"[17] Of course, such momentous changes in the time and cost of education may never be attained, but this somewhat humorous perspective forces the question of what *can* be done to enhance the productive efficiency of universities. I see two areas ripe for innovation: one in educational attainment, the other in the assessment of outcomes rather than inputs.

EDUCATIONAL ATTAINMENT

College is to the 21st century what high school was to the 20th century, or what a primary education was to the 19th century. A university education is now the starting point, just as high school was early in the 20th century. Therefore, educational attainment, the amount of material mastered in a given time period, must be increasingly compressed in time.

Achieving a higher level of education in fewer years has financial implications. The years "saved" result in fewer resources being expended to achieve the same educational level per unit of time, which means that human capital can be deployed earlier. The U.S. has made some efforts to accelerate educational attainment. Ohio, for example, has started a "seniors to sophomores" program and has had a 2+4 BS/MD program for many years. Similar programs now are being seen in many countries by way of early college and advanced placement programs; the savings in those countries, however, are compounded because they start from a higher level of attainment. European education covers more advanced subjects earlier than the U.S., as anyone who has moved between Europe and the U.S. knows. According to a 2007 report by the National Center on Education and the Economy, "While our international counterparts are increasingly getting more education, their young people are getting a better education as well. . . . A number of other countries assume that their students are ready for college—really ready for college—when they are 16 years old."[18]

Furthermore, if college is now equivalent to high school, the nature of tertiary education itself must be redefined. That challenge, barely yet discussed, is worthy of attention because significant innovation opportunities will surely arise just from exploring the question, what will be the "higher" in the next generation of higher education?

PERFORMANCE AND PRODUCTIVITY METRICS[19]

Probably the biggest impediment to advancing the performance and productivity of universities lies in the fact that academic "excellence" is defined largely by selectivity and expense: how many students are excluded and how much money is spent per student. Thus, if we are going to make any headway in even talking about productivity, this prevailing definition of educational "quality" must be replaced by new performance metrics that reflect outcomes in enabling student success and achievements in solving real-world problems.

This is too large a topic to address fully in this essay, but some insights can be derived by asking what is needed to improve how research universities are ranked and how their competitiveness is assessed. At present, research rankings use only input measures, namely, the amount of funding for research. The more-is-better logic of research rankings is flawed because, in the absence of normalized output measures, it is difficult to make meaningful comparisons between large and small research universities, or even between specific research programs within universities. If research productivity is equal, why should a university that spends more

money for research be ranked higher than one that spends less? Some universities have much larger rates of patenting and commercialization than those with comparable research budgets, and all surveys that assess patenting and commercialization ratios expressed as a fraction of research income show no correlation, especially when scaled. For instance, the annual licensing surveys of the Association of University Technology Managers suggest that the institutions deemed the most productive in terms of output per million dollars of research activity are not those at the top of the traditional rankings.[20]

Whether we like it or not, the call for accountability, affordability, and accessibility, as well as the need for pervasive innovation, requires us to seek new performance standards for the excellence of our universities—standards that do not presume that only selectivity, size, and expense define excellence.

Because there are no established frameworks, a good beginning would be to characterize research competitiveness and productivity separately. Productivity should be a measure of research outcomes expressed as a ratio to funding inputs and, again, normalized by number of researchers. Competitiveness should be a measure of success in the R&D marketplace, normalized by number of researchers and by changes in funding success gauged against the size and growth of the available pool of funds. What is more, universities differ considerably in their research portfolios—which areas of research they specialize in. For example, universities with medical schools attract more biomedical research funding, in part because federal funding for biomedical research constitutes about 70 cents of every research dollar.

Indeed, universities themselves and funding agencies would be served better by information about outcomes—the research performance of universities. A starting point could be the methodology employed by Graham and Diamond, which included comparisons of research funding and publications, scaled by faculty size, and comparisons between private and public universities.[21] That approach is worth revisiting, refining, and building upon. Recently, Martin and his colleagues at Academic Analytics have extended this approach by accessing research funding, publications, and citation data in a powerful methodology.[22]

Of course, there are other opportunities to create greater productivity and foster efficient uses of resources. Just as there is no single model or form that defines a research university, there is also 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.

A NEW GOLD STANDARD

Whether we like it or not, the call for accountability, affordability, and accessibility, as well as the need for pervasive innovation, requires us to seek new performance standards for the excellence of our universities—standards that do not presume that only selectivity, size, and expense define excellence. This is what Michael Crow at Arizona State University and we at The University of Akron are calling a new gold standard of university performance, a fresh and definitive standard appropriate to our times. [23]

These are its principles:

- Unlike others, we shall be measured by how much value we add in enabling the success of our students, not by how many students we exclude.
- Unlike others, we shall be measured by the integration of our disciplines as applied in solving the problems of today, not by their isolation.
- Unlike others, we will be measured by the collaborative impact we create for each other and for our common future, not by the barriers we erect between our communities and ourselves.

Since antiquity, education has been the gauge of progress for any civilization. Today, higher education is on the threshold of its own revolution. It is facing complex major changes that must be directed toward optimal outcomes if universities are to continue as major players in the rapidly evolving global economy.

---

1. "Seismic rumbles of change" is a phrase borrowed from Chuck Vest, "Vest Urges Continued Support for U.S. Science." Cambridge, MA: Massachusetts Institute of Technology News Office, February 15, 1995.
2. L. M. Proenza, *Clusters and Collaborations in the New Research Economy: Creating Strategic Intent among Universities in Building Cross-University Alliances That Enhance Research*, Merrill Center publication on the Research Mission of Public Universities, No. 103. Valley Falls, KS: University of Kansas, July 1999.
3. R. L. Geiger, *Research and Relevant Knowledge: American Research Universities since World War II* (2nd ed.). New Brunswick, NJ: Transaction Publishers, 2004. (Original ed., Oxford University Press, 1993)
4. H. D. Graham and N. Diamond, *The Rise of American Research Universities: Elites and Challengers in the Postwar Era*. Baltimore: The Johns Hopkins University Press, 1997.
5. L. Alexander, "Why College Shouldn't Take Four Years," *Newsweek*, October 26, 2009.
6. E. G. Gee, "Universities Can Survive Only with Radical Reform," *The Christian Science Monitor*, March 13, 2009.
7. J. Immerwahr and J. Johnson, with P. Gasbarra, A. Ott, and J. Rochkind, "Squeeze Play: How Parents and the Public Look at Higher Education Today," report prepared by Public Agenda for the National Center for Public Policy and Higher Education, 2007.
8. L. M. Proenza and N. L. Zimpher, "Reaching beyond Boundaries: How Anchor Universities Can

Rebuild Cities and Revitalize Neighborhoods," white paper written for the Brookings Institution, publication pending.
9. D. C. Perry, "Enclaves to Anchor Institutions: Global Universities—Their Cities, Economy and Land," presentation to the Urban Land Institute and Wayne State University, Detroit, October 7, 2008.
10. L. J. Perelman, "Closing Education's Technology Gap," Hudson Institute Briefing Paper No. 111, November 28, 1989.
11. President's Council of Advisors on Science and Technology, "University-Private Sector Research Partnerships in the Innovation Ecosystem," report to the President of the United States, 2008. Available at http://www.whitehouse.gov/files/documents/ostp/PCAST/past_research_partnership_report_BOOK.pdf.
12. Council on Competitiveness, "Innovate America," National Innovation Initiative Summit and report, 2005.
13. National Science Board, "2010 Science and Engineering Indicators." Available at http://www.nsf.gov/statistics/seind10/c/cs1.htm.
14. M. Mandel, with S. Hamm and C. J. Farrell, "Why the Economy Is a Lot Stronger Than You Think." *BusinessWeek* online, February 13, 2006.
15. *Washington Post* National Weekly Edition, May 9-15, 1988.
16. *Washington Post* National Weekly Edition, May 9-15, 1988.
17. *Washington Post* National Weekly Edition, December 25-31, 1989.
18. The New Commission on the Skills of the American Workforce, *Tough Choices or Tough Times.* Washington, DC: National Center on Education and the Economy, 2007.
19. Based on L. M. Proenza, "Beyond Research Rankings," *Inside Higher Education*, May 17, 2007. Available at http://www.insidehighered.com/views/2007/05/17/proenza.
20. AUTM Annual Licensing Surveys are available online at http://www.autm.net/Surveys.htm.
21. Graham and Diamond, *The Rise of American Research Universities.*
22. For more information on the work and methodology of Martin and his partners, see the Academic Analytics Web site at http://www.academicanalytics.com/.
23. M. M. Crow, "A New American University: The New Gold Standard," policy paper, Arizona State University, November 2002.