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The Role of the University: Leveraging Talent, Not Technology

We are in danger of undermining the value of research universities if we regard them simply as sources of technology.

During the 1980s, the university was posed as an underutilized weapon in the battle for industrial competitiveness and regional economic growth. Even higher education stalwarts such as Harvard University's then-president Derek Bok argued that the university had a civic duty to ally itself closely with industry to improve productivity. At university after university, new research centers were designed to attract corporate funding, and technology transfer offices were started to commercialize academic breakthroughs.

However we may well have gone too far. Academics and university officials are becoming increasingly concerned that greater involvement in university research is causing a shift from fundamental science to more applied work. Industry, meanwhile, is growing upset over universities' increasingly aggressive attempts to profit from industry-funded research, through intellectual property rights. In addition, state and local governments are becoming disillusioned that universities are not sparking the kind of regional growth seen in the classic success stories of Stanford University and Silicon Valley in California and of MIT and the Route 128 beltway around Boston. As John Armstrong, former IBM vice president for science and technology, recently noted, policymakers have overstated the degree to which universities can drive the national and regional economies.

Universities have been naively viewed as "engines" of innovation that pump out new ideas that can be translated into commercial innovations and regional growth. This has led to overly mechanistic national and regional policies that seek to commercialize those ideas and transfer them to the private sector. Although there is nothing wrong with policies that encourage joint research, this view misses the larger economic picture: Universities are far more important as the nation's primary source of knowledge creation and talent. Smart people are the most critical resource to any economy, and especially to the rapidly growing knowledge-based economy on

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which the U.S. future rests. Misdirected policies that restrict universities' ability to generate knowledge and attract and produce top talent suddenly loom as large threats to the nation's economy. Specific measures such as the landmark Bayh-Dole Act of 1980, which enable universities to claim ownership of the intellectual property rights generated from federally funded research, have helped universities commercialize innovations but in doing so may exacerbate the skewing of the university's role.

If federal, state, and local policymakers really want to leverage universities to spawn economic growth, they must adopt a new view. They have to stop encouraging matches between university and industry for their own sake. Instead, they must focus on strengthening the university's ability to attract the smartest people from around the world—the true wellspring of the knowledge economy. By attracting these people and rapidly and widely disseminating the knowledge they create, universities will have a much greater effect on the nation's economy as well as regional growth. For their part, universities must become vigilant against government policies and industry agreements that limit or delay the intellectual property researchers can disclose. These requirements, which are mounting daily, may well discourage or even impede the advancement of knowledge, which retards the efficient pursuit of scientific progress, in turn slowing innovation in industry.

The partnership rush

In the new economy, ideas and intellectual capital have replaced natural resources and mechanical innovations as the raw material of economic growth. The university becomes more critical than ever as a provider of talent, knowledge, and innovation in the age of knowledge-based capitalism. It provides these resources largely by conducting and openly publishing research and by educating students. The university is powered in this role by generating new discoveries that increase its eminence. In this way, academic research differs markedly from industry R&D, which is powered by the profit motive and takes place in an environment of secrecy.

In order to generate new discoveries and become more eminent, the university engages in a productive competition for the most revered academics. The presence of this top talent, in turn, attracts outstanding graduate students. They further enhance the university's reputation, helping to attract top undergraduates, and so on. The pursuit of eminence is reflected in contributions to new knowledge, typically embodied in academic publication.

Universities, however, like all institutions, require funding to pursue their objectives. There is a fundamental tension between the pursuit of eminence and the need for financial resources. Although industry funding does not necessarily hinder the quest for eminence, industry funds can and increasingly do come with restrictions, such as control over publishing or excessive secrecy requirements, which undermine the university's ability to establish academic prestige. This phenomenon is not new: At the turn of the century, chemistry and engineering departments were host to deep struggles between faculty who wanted to pursue industry-oriented research and those who wanted to conduct more basic research. Rapidly expanding federal research funding in the decades after World War II temporarily eclipsed that tension, but it is becoming more accentuated and widespread as knowledge becomes the primary source of economic advantage.

University ties to industry have grown extensively in recent times. Industry has become more involved in sponsored research, and universities have focused more on licensing their technology and creating spin-off companies to raise money. Between 1970 and 1997, for example, the share of industry funding of academic R&D rose sharply from 2.6 percent to 7.1 percent, according to the National Science Foundation (NSF). Patenting by academic institutions has grown exponentially. The top 100 research universities were awarded 177 patents in 1974, then 408 in 1984, and 1,486 in 1994. In 1997, the 158 universities in a survey conducted by the Association of University Technology Managers applied for more than 6,000 patents. Universities granted roughly 3,000 licenses based on these patents to industry in 1998—up from 1,000 in 1991—generating roughly $500 million in royalty income.

Furthermore, a growing number of universities such as Carnegie Mellon University (CMU) and the University of Texas at Austin have become directly involved in the incubation of spin-off companies. Carnegie Mellon University (CMU) hit the jackpot with its incubation of Lycos, the Internet search engine company; it made roughly $25 million on its initial

equity stake in Lycos when the company went public. Other universities have joined in the startup gold rush, but this puts them in the venture capital game, a high-stakes contest where they don't belong. Boston University, for example, lost tens of millions of dollars on its ill-fated investment in Seragen. These activities do little to advance knowledge per se and certainly don't help attract top people. They simply tend to distract the university from its core missions of conducting research and generating talent. The region surrounding the university may not even benefit if it does not have the required infrastructure and environment to keep these companies in the area; Lycos moved to Boston because it needed high-level management and marketing people it could not find in Pittsburgh.

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Joint university-industry research centers have also grown dramatically, and a lot of money is being spent on them. A 1990 CMU study of 1,056 of these U.S. centers (those with more than $100,000 in funding and at least one active industry partner), conducted by CMU economist Wesley Cohen and myself, showed that these centers had total funding in excess of $4.12 billion—and that was nine years ago. The centers involved 12,000 university faculty and 22,300 doctoral-level researchers—a considerable number.

Academic entrepreneursIn recent years, a debate has emerged over what motivates the university top-ursue closer research ties with industry. The "corporate manipulation" view is that corporations seek to control relevant research for their own ends. In the "academic entrepreneur" view, university faculty and administrators act as entrepreneurs, cultivating opportunities for industry and public funding to advance their own agendas. The findings of the CMU survey just mentioned support the academic entrepreneur thesis. Some 73 percent of the university-industry research centers indicated that the main impetus for their formation came from university faculty and administrators. Only 11 percent reported that their main impetus came from industry.

This university initiative did not occur in a vacuum, though. It was prompted by federal science and technology policy. More than half of all funding for university-industry research centers comes from government. Of the centers in the CMU survey, 86 percent received government support, 71 percent were established based on government support, and 40 percent reported they could not continue without this support.

Three specific policies hastened the move toward university-industry research centers. The Economic Recovery Tax Act of 1981 extended industrial R&D tax breaks to research supported at universities. The Patent and Trademark Act of 1980, otherwise known as the Bayh-Dole Act, permitted universities to take patents and other intellectual property rights on products created under federally funded research and to assign or license those rights to others, frequently industrial corporations. And NSF established several programs that tied federal support to industry participation, such as the Engineering Research Centers, and Science and Technology Centers. Collectively, these initiatives also encouraged universities to seek closer research ties to business by creating the perception that future competition for federal funds would require demonstrated links to industry.

The rush to partner with industry has caused uncomfortable symptoms to arise. Industry is becoming more concerned with universities' overzealous pursuit of revenues from technology transfer, typically at the hands of technology transfer offices and intellectual property policies. Large firms are most upset that even though they fund research up front, universities and their lawyers are forcing them into unfavorable negotiations over intellectual property when something of value emerges. Angered executives at a number of companies are taking the position that they will not fund research at universities that are too aggressive on intellectual property issues. One corporate vice president for industrial R&D recently summed up the sentiment of large companies, saying, "The university takes this money, then guts the relationship."

Smaller companies are concerned about the time delays in getting research results, which occur be-

cause of protracted negotiations by university technology-transfer offices or attorneys over intellectual property rights. The deliberations slow the process of getting new technology to highly competitive markets, where success rests on commercializing innovations and products as soon as possible. Some of the nation's largest and most technology-intensive firms are beginning to worry aloud that increased industrial support for research is disrupting, distorting, and damaging the underlying educational and research missions of the university, retarding advances in basic science that underlie these firms' long-term future.

Critics contend that growing ties to industry skew the academic research agenda from basic toward applied research. The evidence here is mixed. Studies by Diane Rahm and Robert Morgan at Washington University in St. Louis found a small empirical association between greater faculty involvement with industry and more applied research. Research by Harvard professor David Blumenthal and others showed that industry-supported research in biotechnology tended to be "short term." But National Science Foundation statistics show that overall, the composition of academic R&D has remained relatively stable since 1980, with basic research at about 66 percent, although this is down from 77 percent in the early 1970s.

The larger and more pressing issue involves growing secrecy in academic research. Most commentators have posed this as an ethical issue, suggesting that increased secrecy contradicts the open dissemination of scientific knowledge. But the real problem is that secrecy threatens the efficient advancement of scientific frontiers. This is particularly true of so-called disclosure restrictions, which govern what can be published and when. Over half of the centers in the CMU survey said that industry participants could force a delay in publication, and more than a third reported that industry could have information deleted from papers prior to publication.

Some have argued that the delays are relatively short and that the withheld information is of marginal importance in the big picture of science. But the evidence does not necessarily support this view. A survey by Harvard's Blumenthal and collaborators indicated that 82 percent of companies require academic researchers to keep information confidential to allow for filing a patent application, which typically can take two to three months or more. Almost half (47 percent) of firms report that their agreements occasionally require universities to keep results confidential for even longer. The study concludes that participation with industry in the commercialization of research is "associated with both delays in publication and refusal to share research results upon request." Furthermore, in a survey by Rahm of more than 1,000 technology managers and faculty at the top 100 R&D-performing universities in the United States, 39 percent reported that firms place restriction on information-sharing by faculty. Some 79 percent of technology managers and 53 percent of faculty members reported that firms had asked that certain research findings be delayed or kept from publication.

These conditions also heighten the chances that new information will be restricted. A 1996 Wall Street Journal article reported that a major drug company suppressed findings of research it sponsored at the University of California San Francisco. The reason: The research found that cheaper drugs made by other manufacturers were therapeutically effective substitutes for its drug, Synthroid, which dominated the $600-million market for controlling hypothyroidism. The company disallowed publication of the research in a major scientific journal even though the article had already been accepted. In another arena, academic economists as well as officials at the National Institutes of Health have openly expressed concern that growing secrecy in biotechnology research may be holding back advances in that field.

Despite such troubles universities continue to seek more industry funding, in part because they need the money. According to Pennsylvania State University economist Irwin Feller, the most rapidly increasing source of academic research funding is the university itself. Universities increasingly believe that they must invest in internal research capabilities by funding center and laboratories in order to compete for federal funds down the road. Since most schools are already strapped for cash and state legislatures are trimming budgets at state schools, more administrators are turning to licensing and other technology transfer vehicles as a last resort. CMU is using the $25 million from its stake in Lycos to finance endowed chairs in computer science and the construction of a new building for computer science and multimedia research.

Spurring regional development

The role of the university as an engine for regional economic development has captured the fancy of business leaders, policymakers, and academics, and led them astray. When they look at technology-based regions such as Silicon Valley in California and Route 128 around Boston, they conclude that the university has powered the economic development there. A theory of sorts has emerged that assumes that there is a linear pathway from university science and research, to commercial innovation to an ever-expanding network of newly formed companies in the region.

The Bayh-Dole Act should be reevaluated in light of the new understanding of the importance of the university as a talent generator.

This is a naïve, partial, and mechanistic view of the way the university contributes to economic development. It is quite clear that Silicon Valley and Route 128 are not the only places in the United States where excellent universities are working on commercially important research. The key is that communities surrounding universities must have the capability to absorb and exploit the science, innovation, and technologies that the university generates. In short, the university is a necessary but not sufficient condition for regional economic development.

Michael Fogarty and Amit Sinha of Case Western Reserve University in Cleveland have examined the outward flow of patented information from universities and have identified a simple but illuminating pattern: There is a significant flow of intellectual property from universities in older industrial regions such as Detroit and Cleveland to high-technology regions such as the greater Boston, San Francisco, and New York metropolitan areas. Their work suggests that even though new knowledge is generated in many places, it is only those regions that can absorb and apply those ideas that are able to turn them into economic wealth.

In addition to its role in incubating innovations and transferring commercial technology, the university plays an even broader and more fundamental role in the attraction and generation of talent—the knowledge workers who work in and are likely to form entrepreneurial high-tech enterprises. The labor market for knowledge workers is different from the general labor market. Highly skilled people are also highly mobile. They do not necessarily respond to monetary incentives alone; they want to be around other smart people. The university plays a magnetic role in the attraction of talent, supporting a classic increasing-returns phenomenon. Good people attract other good people, and places with lots of good people attract firms who want access to that talent, creating a self-reinforcing cycle of growth.

A key and all too frequently neglected role of the university in the knowledge economy is as a collector of talent—a growth pole that attracts eminent scientists and engineers, who attract energetic graduate students, who create spin-off companies, which encourages other companies to locate nearby. Still, the university is only one part of the system of attracting and keeping talent in an area. It is up to companies and other institutions in the region to put in place the opportunities and amenities required to make the region attractive to that talent in the long run. If the region does not have the opportunities or if it lacks the amenities, the talent will leave.

Focus groups I have recently conducted with knowledge workers indicate that these talented people have many career options and that they can choose where they want to live and work. They want to work in progressive environments, frequent upscale shops and cafes, enjoy museums and fine arts and outdoor activities, send their children to superior schools, and run into people at all these places from other advanced research labs and cutting-edge companies in their neighborhoods. Researchers who do leave the university to start companies need quick access to venture capital, top management and marketing employees, fast and cheap Internet connections, and a pool of smart people from which to draw employees. They will not stick around the area if they can't find all these things. What's more, young graduates know they will probably change employers as many as three times in 10 years, and they will not move to

an area where they do not feel there are enough quality employers to provide these opportunities. Stanford didn't turn the Silicon Valley area into a high-tech powerhouse on its own; regional actors built the local infrastructure this kind of economy needed. The same was true in Boston and, more recently, in Austin, Texas, where regional leaders undertook aggressive measures to create incubator facilities, venture capital, outdoor amenities, and the environmental quality that knowledge workers who participate in the new economy demand.

Universities should take the lead in establishing shared and enforceable guidelines for limiting disclosure restrictions in research.

It is important to note that this cycle has to not only be triggered by regional action, but also sustained by it. Over time, any university or region must be constantly repopulated with new talent. More so than industrial economies, leading universities and labor markets for knowledge workers are distinguished by high degrees of "churning." What matters is the ability to replenish the talent stock. This is particularly true in advanced scientific and technical fields, where learned skills (such as engineering degrees) tend to depreciate rather quickly.

Regions that want to leverage this talent, however, have to wake up and realize that they must make their areas attractive to this talent. In the industrial era, regions worked hard to attract factories that spewed out goods, paid taxes, and increased demand for other local businesses. Regional authorities built infrastructure and even offered financial inducements. But pressuring universities to develop more ties with local industry or expand technology transfer programs can have only a limited effect in the knowledge economy, because they fail to recognize what it takes to build a truly vibrant regional economy that can harness innovation and retain and attract the best talent the knowledge economy has to offer.

The path to prudent policy

The new view of the university as fueling the economy primarily through the attraction and creation of talent as well as by generating innovations has important implications for public policy. To date, federal, state, and local public policy that encourages economic gain from universities has been organized as a giant "technology push" experiment. The logic is: If the university can just push more innovations out the door, those innovations will somehow magically turn into economic growth. Clearly, the economic effects of universities emanate in more subtle ways. Universities do not operate as simple engines of innovation. They are a crucial piece of the infrastructure of the knowledge economy, providing mechanisms for generating and harnessing talent. Once policymakers embrace this new view, they can begin to update or craft new policies that will improve the university's impact on the U.S. knowledge economy. We do not have to stop promoting university-industry research or transferring university breakthroughs to the private sector, but we must support the university's role in the broader creation of talent.

At the national level, government must realize that the United States has to attract the world's best talent and that a completely open university research system is needed to do so. It is probably time for a thoroughgoing review of the U.S. patent system and federal laws such as the Bayh-Dole Act, which incorporates a framework for protecting intellectual property that is based on the model of the university as an innovation engine. It must be reevaluated in light of the framework based on a university as a talent magnet.

Regional policymakers have to reduce the pressure on universities to expand technology transfer efforts in order to bolster the area's economy. They can no longer slough off this responsibility to university presidents. They have to step up themselves and ensure that the infrastructure their region has to offer will be able to attract and retain top talent and be able to absorb academic research results for commercial gain.

Meanwhile, business, academic, and policy leaders need to resolve thorny issues that are arising as symptoms of bad current policy, such as disclosure

restrictions, which may be impeding the timely advancement of science, engineering, and commercial technology. Individual firms have clear and rational incentives to impose disclosure restrictions on work they fund to ensure that their competitors do not get access. But as this kind of behavior multiplies, more and more scientific information of potential benefit to many facets of the economy is withheld from the public domain. This is a vexing problem that must be solved.

Universities need to be more vigilant in managing this process. One solution, which would not involve government at all, is for universities to take the lead in establishing shared and enforceable guidelines limiting disclosure restrictions. In doing so, universities need to reconsider their more aggressive policies toward technology transfer and particularly regarding the ownership of intellectual property.

Since we are moving toward a knowledge-based economy, the university looms as a much larger source of economic raw material than in the past. If our country and its regions are really serious about building the capability to prosper in the knowledge economy, they will have to do much more than simply enhance the ability of the university to commercialize technology. They will have to create an infrastructure that is more conducive to talent. Here, ironically, policymakers can learn a great deal from the universities themselves, which within their walls have been creating environments conducive to knowledge workers for a very long time.

Recommended reading

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