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Universities Should Not Become Research Units of Corporations

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Over the past decade, the university has come to be viewed as a major weapon in America's battle for global competitiveness, supplying technological breakthroughs with the promise of big commercial payoffs. In a landmark article published in 1981, Harvard University President Derek Bok wrote that the university had a civic duty to ally itself more closely with private industry in an effort to counteract foreign competition and improve productivity. In the next few years, a host of new university-industry connections were forged, and in the burgeoning field of biotechnology, major universities and large corporations signed multi-year, multimillion-dollar research contracts.

The development of new science-based industries, such as superconductivity, generated even more corporate interest in academic science. As the commercial implications became clear, corporations scrambled to gain access to leading university researchers. Universities, facing cutbacks in federal research support, not only welcomed industry money but became increasingly aggressive in their efforts to get it. Entrepreneurial scientists also were quick to jump at increased research support and at the big consulting fees or blocks of stock in start-up companies that some corporations offered.

New directions in government policy have fueled the explosion in university-industry relations. When Erich Bloch was its director, the National Science Foundation made university-industry centers a cornerstone of its mission, establishing a host of engineering-research centers at universities around the country. Industry's role was to contribute matching funds and potentially to commercialize the research results. The states, too, have

jumped into the breach: A recent study indicates that 48 now sponsor university-industry programs, with annual expenditures totaling \$550-million.

The increase in public funding for university-industry centers and consortia is not surprising in light of the fact that industry-financed research and development in the United States have not kept up with the pace worldwide. Industry benefits from federal and state support, since the more research and development the government subsidizes, the more private capital can be freed up for activities such as takeovers, increased dividends, and stock buy-backs. The political motives behind the explosion in government-supported technology centers are also clear. These programs offer an opportunity for every senator and representative -- and every university -- to join the crusade to improve U.S. competitiveness. Investment in these programs is simply a modern version of pork-barrel funding.

Research arrangements between higher education and industry now extend across virtually every field of science and technology and into colleges and universities of all types and sizes. More than 1,000 university-industry research centers exist at about 450 universities. But industry and universities are jointly involved in more than just pure research: A growing number of universities are granting industry privileged access to their technologies. Some universities have become venture capitalists themselves in an effort to promote technology and profit from it. Stanford and others operate and maintain expensive semiconductor-fabrication facilities, and several institutions, e.g., the University of South Carolina, now are building or have plans to build small manufacturing facilities on their campuses to turn ideas into products.

While university-industry ties are hailed as one major way to restore U.S. industrial competitiveness, our research on high-technology industry suggests that this view is erroneous. University research cannot solve the underlying problems of our industrial decline; rather, the fundamental problems -- and solutions -- lie within the American corporate system itself. This system increasingly is unable to transform scientific and other cutting-edge innovations into competitive products and lacks the

state-of-the-art manufacturing processes needed to rebuild America's industrial might. American corporations suffer from the illusion that scientific breakthroughs are the key to technological superiority and industrial competitiveness. But big new ideas must be turned into products; this requires an ability to make continual improvements in existing products and manufacturing processes. This is where our industrial system fails, and this is where our most successful competitors excel.

Three factors account for America's declining ability to compete with other countries technologically and industrially:

* The separation of research and development from manufacturing. Most American corporations have separated their research labs from their factories. Naively believing that scientists and engineers require isolation, many U.S. corporations conduct their research and development in pristine suburban "research parks" or, more recently, on university campuses, far removed from factory production. This makes it difficult, and at times impossible, for the communication and personal interactions to occur that often are required to turn innovative ideas into successful commercial products. The best example of such a failure is Xerox and its famed Palo Alto Research Center. While PARC generated many of the ideas for products associated with modern personal and office computing -- early versions of a Macintosh-like computer, laser printers, stand-alone engineering work stations, computer-networking systems, and many others - - Xerox was unable to convert the ideas into successful products because its top management was unable to see how to move the ideas from the research-and-development center to the company's production lines.

* The failure to nurture innovation among factory workers. In most U.S. corporations, factory workers are seen as merely "cogs in the machine" with little to contribute to innovation and product development. In fact, several university-industry research centers are devoted to replacing workers with computer-driven machines.

However, today's most competitive companies -- in Japan, to a lesser extent in Europe, and even in the United States --

recognize that the key to success rests in the ideas and combined intelligence of the entire work force, especially factory workers who have the practical knowledge needed to improve production systems and manufacturing processes. In such companies, workers suggest ways to improve production, work in groups to solve actual manufacturing problems, and interact with scientists and engineers to develop the new processes required to turn innovations into mass-produced goods.

* The emphasis on military applications of technology. A large share of corporate and university research in the United States is devoted to developing military rather than commercial technology. Many U.S. companies have abandoned important consumer-product lines in favor of building up lucrative military business. In addition, a significant share of universities' federal research money comes from the Pentagon, causing them to direct their scarce scientific resources toward defense and away from commercial technology.

People often argue that defense technologies benefit industry and the economy because they generate commercial "spill-overs." However, recent research contradicts this argument. For example, a semiconductor made to withstand the extreme heat and conditions of the battlefield is too expensive, specialized, and complex to be sold on the commercial market, where, to make a profit, companies must produce large volumes of relatively standardized products at low cost. Moreover, U.S. military spending has created a sheltered "grants economy" characterized by cost overruns, budget padding, and little competition -- companies need not produce profitable products and services at a low cost to win military contracts. Such an economy allows corporations to generate huge profits while avoiding the organizational restructuring and market discipline required to be globally competitive.

A number of companies actually segregate their defense and commercial businesses, to prevent the uncompetitive practices in their military divisions from "infecting" their commercial enterprises, which must stand up to the test of the marketplace. Unfortunately, the recent war in the Persian Gulf will probably insure a renewed commitment to defense technology in the

United States, making the needed movement from military to civilian research, development, and technology even harder to achieve.

It is likely that foreign companies will be more successful than their American counterparts at turning our universities' science and technology into products. Indeed, the increasing number of alliances between Japanese companies and American universities, for example, is in keeping with broader trends in the globalization of high-technology industry: Witness the recent wave of mergers, acquisitions, and strategic alliances between small American start-up companies and large Japanese corporations. Foreign corporations and financiers, especially the Japanese, are even providing an increasing proportion of venture capital to finance new American companies, accelerating the flow of American technology to their own countries. These trends are in line with the new international division of labor occurring in high-technology industry in which the United States makes scientific breakthroughs and other countries, especially Japan, provide the follow-through by developing products based on our discoveries.

Further, the emphasis on university-industry relations in this country has created a climate ripe for problems and abuse. Graduate students may be channeled into applied fields, where ready support is available, and away from more basic scientific endeavors. The corporate partners in university-industry centers demand real "products" and place restrictions on faculty members' publications and the sharing of knowledge in a collegial environment. University administrators increasingly complain that large corporations play one institution against another to get even greater access to and control over scientific and technological knowledge.

The situation has become so problematic that even some of the original architects and promoters of university-industry alliances are raising questions about them. Derek Bok, in *Universities and the Future of America* (Duke University Press, 1990), suggests that university-industry agreements have not been "an effective strategy . . . for allowing American companies to maintain a decisive lead over foreign competitors."

It is a mistake to push universities into becoming the research-and-development units of American and/or foreign corporations. They have other very important missions -- educating new generations of scientists, providing space for the free interchange of ideas, and generating powerful new ideas. And in the end, universities can do little to remedy the underlying industrial and technological problems facing our economy. Not even a hundred, a thousand, or a million new university innovations could solve the problems of American industry. The United States is not losing out to the Japanese because their universities are better than ours at developing commercial technology or because their universities are more closely linked to their industry. American industry is losing because foreign competitors have the product-development and manufacturing skills needed to turn innovations into the products the world wants. We do not.

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