

With their concentrations of scientific talent and other resources, metropolitan universities can be significant catalysts for economic development in their communities. In order for metropolitan universities to make an impact, however, they must be very selective, building upon traditional or emerging program strengths that are consistent with the character and needs of the local or regional economy. This article describes strategies, ranging from internal policy making to creating forums for industry-university ties, for preparing a metropolitan university for this role.

A Catalyst for Economic Development

Last June, Robert Winer, president of the Akron Polymer Container Corporation, unveiled the Akro, a non-aerosol container he believes could replace the ordinary spray can. He is now negotiating international licensing agreements, locating production facilities, and contemplating marketing applications, and feels that he is on the road to launching a successful new product.

While the Akro appears to promise prosperity for Winer, it also is an example of the tangible results that can be forged through university partnerships with the public and private sector. Two years ago, as a former marketing executive, Winer brought his idea to polymer engineers at The University of Akron. Supported by a \$220,000 industrial development loan through Ohio's Thomas Edison Program, university researchers and Winer teamed together to develop the unique concept of using rubber as a propellant, instead of environmentally harmful gases such as chlorofluorocarbons. Industry observers predict that such a product, if it is produced and marketed successfully, could provide an ecologically sound, lower cost alternative to the aerosol can.

Stories like the development of Akro are becoming more common today as colleges and universities assume a greater role in the economic development of their communities. In this role, the university acts as a catalyst, using its research capabilities to help translate lab discoveries into commercial reality.

While cooperation between industry and higher education is not new, the idea of higher education as an instrument of economic development is of relatively recent vintage. Until recently, higher education's in-

vovement took an indirect route, following the longstanding notion that education in and of itself will produce a better society. That implicitly is a very slow process.

Now instead of merely counting on instruction to spark economic development and seeing research primarily as a creative exploration, faculty are being asked to see their work as a means to a new end—that of bringing a new knowledge and technology to fruition. Obviously, that is a fundamental change in the way higher education operates.

Whether it is fair or not, universities have long been characterized as ivory towers, existing as insulated and isolated enclaves, sheltered from the harsh 'real world.' In too many cases, that characterization has been accurate.

Selectivity a Key

Having the tools and the motives, however, is not enough. Each university must carefully choose areas in which it can make an impact. It must be very selective, building upon traditional or emerging program strengths that are consistent with the character and needs of the local or regional economy. In the farm belt, a university might select priorities related to agriculture, as indeed has been done by the agricultural units of our land-grant universities since 1887, when the Hatch Act established experiment stations. In highly industrialized areas, a university might emphasize fields related to certain key industries or commercial operations. In coastal areas, priorities might be geared toward serving the needs of fisheries or other marine resources.

In theory, it sounds simple enough. However, in accepting a role in economic development, the university must also be prepared to cope with internal change and to meet an entirely new set of expectations that come with the territory.

While corporations have embraced strategic planning for years, it can be a difficult, even painful process for universities. One of the central and cherished ideals of higher education is that of a democracy, treating all colleagues and programs as equals. When universities plan strategically, some programs receive priorities. Others—not accorded the same attention and support—are likely to be viewed by faculty as having been de-emphasized. That goes against the grain of many faculty, spawning internal dissension and the lack of a cohesive commitment to the university's role in economic development.

Dissension can be reduced, however, by ensuring broad-based participation in the setting of priorities. Planning should involve faculty and administrators from throughout the university.

Generally, people are more likely to accept priorities if they participate in decision making and understand the rationale for final conclusions. Some resentment will occur, but the key is to keep it from being counterproductive.

To gain widespread involvement in economic development activities at the University of Akron, a strategic planning and review committee, known as SPARC, was formed to direct long-range planning efforts. SPARC is chaired by the president to ensure involvement and guidance from the chief executive officer and includes all vice-presidents. The committee's membership also includes representatives from the deans, faculty, students and staff.

In its first year, SPARC met biweekly for about nine months before issuing a revised statement of the university's mission and goals, a set of major institutional objectives, and parameters for the long-range plan. With the aid of an academic planning and priorities committee appointed by the University of Akron's University Council, 13 academic programs out of a total 240 at the university were targeted for special enhancement. Further, each operating unit was required to develop a five-year plan within the overall framework and priorities.

One academic area selected for priority enhancement was polymer science and engineering. Much of the remainder of this paper will describe the university's efforts in pursuing this goal.

Coping with great expectations. Externally, expectations also change as a university becomes involved in economic development efforts. By taking a leadership position, the university becomes increasingly accountable to the public and private sector who invest in the research and want to see a return on their investment.

The problem is not being able to produce results as much as it is producing results within a realistic time frame. When politicians invest in university research centers, they look for short-term results to pacify their constituents. That means the university is expected to deliver in as little as two to four years. Frankly, those expectations are simply unrealistic. The process of research, development, testing, and licensing is apt to take much longer. Imposing an expectation of quick returns is analogous to asking a marathoner to change events and compete as a sprinter. As well trained as the marathoner is, he simply is out of his element in a dash. Likewise, if the university is to play an integral part in economic development, it must also be allowed to do so within a reasonable time frame. A quick fix is not an event in which universities excel.

But at the same time, universities that receive funding from the public sector must accept, understand, and effectively deal with the

context in which decisions are made in the political arena. Since political leaders who have supported spending on research and development need 'ammunition' to justify major investments of public funds and to strengthen their efforts for reelection, universities must be willing to provide progress reports for projects that are still in early stages of development. These reports must not promise more than can or will be delivered, and they should be stated in terms that politicians and the general public can understand.

Polymers: chains that bind. The University of Akron has employed a strategy of capitalizing on its comparative advantage in polymer research, building upon the city's long-time standing as the Rubber City. With the entrepreneurial efforts of Harvey Firestone, Frank Seiberling, and Benjamin Franklin Goodrich, among others, Akron established itself as the rubber and tire manufacturing capital of the world at the turn of the century.

Naturally, as the rubber industry paced Akron's economy, the university responded to meet the city's educational needs. The University of Akron offered the first course in rubber chemistry in the country by 1909, and its scientists performed much of the pioneering research in the field, particularly in the development of synthetic rubber.

Subsequently, the University of Akron formed the Office of Rubber Research in the mid-40s, and a decade later, the Institute of Rubber Research. Both served as mechanisms for advancing research in the field. Even after the rubber industry matured and moved its production facilities to other parts of the country and world, eventually shutting down its last tire production line in Akron three years ago, the impetus for a continuing relationship between the university and the business community remained. And when things were at their bleakest in northeast Ohio, the community looked squarely to its local university to engineer a recovery.

The University of Akron has been able to contribute to that recovery for a number of reasons. When the community suffered from an overreliance on the rubber and tire industry, the university saw the writing on the wall. Consequently, the institution diversified its research agenda, and the Institute of Rubber Research evolved into the Institute for Polymer Science, which essentially studies a wide range of materials made from macro-molecules. With its strong roots and broadened agenda, the university's polymer science program became one of the nation's finest. The University of Akron currently has the nation's largest graduate enrollment in polymer science and has produced more Ph.D.'s in this field than any other institution.

In the last five years, the University of Akron has developed a department and research center for polymer engineering, expanding the agenda to methods and technology by which polymers are manufactured and processed. And just last year, the College of Polymer Science and Polymer Engineering was created. It is the only collegiate unit of its kind in this country.

Creating the college was a bold move for the university, uniting the basic and applied aspects of polymer education and research. The synergy of combining the disciplines, formerly split between two colleges, should lead to more significant advances in the long run. The college gives polymers much greater visibility on and off campus, with minimal additional costs of administration.

As these organizational changes occurred, the university vastly expanded physical facilities for the polymer disciplines. To construct a 146,000 square-foot polymer science center, the state granted \$15 million, which was supplemented by more than \$3 million from private industry. Slated for completion in mid-1990, the architecturally-innovative building will house state-of-the-art research labs, classrooms, and faculty offices. Polymer materials were used extensively in its construction.

Private support came not only from Akron-based firms such as Goodyear, BF Goodrich, Firestone, and GenCorp but also from other national and international companies such as Bridgestone, AT&T, Monsanto, and BP America. An additional \$4 million was invested in the renovation of the university research center housing polymer engineering.

In a related effort, the university joined the city, county, and the local private industry council to establish a business incubator on the edge of campus. True to its name, the incubator provides a means of life support for small and newly created businesses. Started in 1983, it has nurtured twenty-two companies with life support in the form of lower-than-market rents, accounting, and legal and managerial assistance. Eight firms have matured and moved to larger quarters, and the entire incubator soon will be relocated to a much larger facility off campus. Most of the companies launched in the incubator have been polymer related.

Along with expanding facilities and strengthening the program's organizational structure and stature, the university aggressively pursued endowments to bring world-class researchers to the faculty. Over the past five years, the institution secured three \$1 million chairs in polymer science and polymer engineering. Two thirds of these funds, or \$2 million, came from private donors. The state contributed \$500,000 each for two of the chairs under an

Eminent Scholars program, which establishes chairs on a competitive basis to bring world-class scholars to Ohio.

It is important to note that costs of the university's polymer initiative increasingly have been borne by external sources. The university simply would not have had the resources to allocate toward emerging priorities without support from the public and private sectors. Last year, for example, the polymer program generated income of \$6.8 million, including nearly \$4 million from external sources. Its expense budget of \$6 million (including faculty salaries and scholarships) contained an internal operating budget allocation of only \$360,000.

The principal university support for polymer education and research has not come in the form of dollars. The designated priority status of the field has brought access to other resources such as space, capital improvements, university selective excellence grants, fund raising, and public relations services.

Forging a regional consortium. While the University of Akron played to its strong suit, Case Western Reserve University in downtown Cleveland, only forty miles north of Akron, developed similar capabilities in macro-molecular science. By most accounts, Akron and Case Western are ranked among the top three polymer programs in the U.S. A few years ago, the schools recognized this tremendous comparative advantage for northeast Ohio and enlisted the region's polymer-related industries in a venture to capitalize on this combined technological leadership. The result emerged as the Edison Polymer Innovation Corporation or EPIC.

The impetus to establish EPIC was provided by the state of Ohio through the Thomas Edison Partnership Program. Under the Edison program, applied technology centers were established at several state universities. The centers broke institutional barriers, linking universities and private industry to effectively exploit emerging science and technology areas that could boost Ohio's economy in the future.

Akron and Case Western established EPIC, one of the first Edison centers, with a \$4.3 million state grant. Charter corporate partners were twelve polymer-related firms based in northeast Ohio; EPIC now comprises 70 corporate members.

Despite the complexity and politics—linking two major universities, one public, one private, as well as private industry and the state of Ohio—EPIC is an excellent example of how universities can serve as a catalyst in sparking economic development. EPIC has attracted over \$1 million in support so far from the likes of Monsanto, Shell, Goodyear, BF Goodrich, Dow, and DuPont—companies that usually square off as fierce rivals. Their contributions have sup-

ported dozens of research projects at both universities, and a number of those are currently under consideration for commercial application.

Negotiating the Future

One project under the direction of Daniel Smith, a chemistry professor at the University of Akron, illustrates both the potential and some avoidable pitfalls in consortium-funded research. Smith created polymer dressings to act as a shock absorber for the foot ulcers of diabetic patients and discovered that the healing process increased dramatically with exposure to these dressings. In addition, his product has the potential to work better, cost less, and last longer than any product with similar properties currently on the market. It is even adaptable enough to be manufactured in the form of the common adhesive bandage.

Because of its incredible market potential, Smith's work attracted the attention of several EPIC members. For the first time, companies in the consortium wanted to compete for the technology. But EPIC organizers had not hammered out agreements in advance of Smith's discovery, governing how the first claim to any licensing rights would be determined.

Eventually, it was agreed that first rights would go to the highest bidder. But the ensuing debate had stalled Smith's research. Specific agreements covering the terms of rights for licensing and royalties should be signed in advance, especially when research is funded by a group rather than one clear corporate sponsor. Currently, all university research agreements—whether or not any patentable invention is anticipated—include these terms. Negotiations are relatively simple when one company is involved and, obviously, become more complex when research is funded by a consortium of companies. But up-front agreements are critical to stave off delays and disagreements over future discoveries.

Strategies that work. In summary, the basic point here is a rather simple one: When a university decides to utilize its resources to stimulate economic development, it must be strategic and selective. Four steps are required to build a path to greater impact:

1. Selectively develop academic programs building upon traditional or emerging strengths. Identify program strengths—in terms of faculty, student resources, laboratory, and other research facilities, among other factors—and develop strategies for exploiting their potential. Careful, strategic planning is needed to select the areas for development.

2. Analyze the university's external environment. Scan the local and regional business environment for key needs and charac-

teristics. Match the needs of the region with the key strengths of the university. The model that the University of Akron has followed with its polymer science program offers a good example.

3. Review and change, where necessary, internal policies regarding faculty research. Ensure that university policies provide incentives for faculty participation in applied research. Is applied research, which may result in a patent rather than an article in a refereed journal, valued in the evaluation process? If not, evaluation criteria should be revised to recognize these achievements.

Other forms of institutional support also are needed: forums for interaction between university scientists and industry decision makers, so they may assess ideas for commercial potential before work progresses, and research support services that assist faculty in securing funding, completing record keeping, and other administrative functions. Revenues resulting from faculty research, such as indirect cost recovery and royalties, should be shared with researchers and their departments. For example, the University of Akron changed its policies to give fifty percent of royalty income from any patented invention to the inventor and share ten percent of the indirect costs recovered from funded research with the principal investigator.

It is important that university policies concerning the sharing of income from inventions be clearly established at the beginning. In some cases, such as the Akro container, the university merely performs a function for which it is paid via a research contract. In that case, there is no resulting income to the institution or the researchers. In other cases, as in Dr. Smith's polymer dressing, the institution and Dr. Smith will share royalty income that results from the licensing agreements on a 50/50 basis.

4. Establish partnerships with industry and governmental agencies. Beginning with the president, high-ranking university officials should participate in forging these ties. Hopefully, the governor, state legislators, and key industrial leaders will see the importance of university-industry-government consortiums in advancing regional development. As these bonds are cemented, all parties should agree to the terms up front: who owns any resulting discoveries, who licenses the technology, how royalties would be determined and shared. Such agreements should help keep research in the lab and out of the courtroom.

In summary, some traditionalists still argue that external partnerships threaten the integrity of higher education. I believe such ties are absolutely essential and can be highly productive, providing that sponsors have a proper understanding of the re-

search process. Public universities today, particularly metropolitan universities, do not operate in a vacuum. They depend upon the public for their support and must be responsive to the needs of the region and the constituencies they serve. This should include directing a university's research and service missions toward perceived local needs.

In many segments of the university, the ideal of scholarship for its own sake still reigns. But in the sciences, business, engineering, and many other fields where research is more likely to be aimed at real-life problems or opportunities, external partnerships are extremely worthwhile.

First, such interaction helps researchers focus their efforts in areas most needed by the region and state and where the potential for commercial application is the greatest. As an example of such a forum, EPIC awards grants upon the recommendation of an industry committee that evaluates proposals on their commercial possibilities.

Second, most universities simply do not have the resources to fund all of the services and research their faculty could provide. Metropolitan universities in particular face considerable demands for services, usually with scarce resources. Few institutions have a large pool of uncommitted dollars available for new priorities. And, student tuition should not be driven up to subsidize economic development programs. The state and private industry must join higher education as partners in advancing economic initiatives.

America's setbacks in the world market in recent years have shown that long-term investments are essential to achieving and sustaining greater competitiveness. Universities can operate as a catalyst, taking the knowledge once reserved for argument in academic journals and translating it into products of incredible potential.

For metropolitan universities, the need for cooperation is particularly acute. They must forge partnerships to enhance economic development in their communities and regions, enhancing the quality of life for their citizens and ensuring a meaningful, dynamic future for themselves.

Suggested Readings

- Keller, G. C. *Academic Strategy: The Management Revolution in American Higher Education*. Baltimore: Johns Hopkins University Press, 1983.

- Business-Higher Education Forum. *Beyond the Rhetoric: Evaluating University-Industry Cooperation in Research and Technology Exchange*. New York: Business-Higher Education Forum, 1988.
- Powers, D. R., Mary F. Powers, F. Betz, and Carol B. Aslanian, *Higher Education in Partnership with Industry*. San Francisco: Jossey-Bass Inc., 1987.