Saving economy through science:[FINAL Edition]

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Full Text (3001 words)

TECH TRANSFORMATION / SPECIAL REPORT: UNIVERSITY

The UA has the brains to change Tucson's future.

But it needs help.

(First of Three Parts)

Toiling in cramped labs across the University of Arizona, researchers are inventing the next generation of DVDs, super grains and cancer drugs.

While the computers hum and the beakers boil, researchers also are mixing up what many hope will be a new economic future for Tucson.

Getting their innovations to market might cure asthma and detect anthrax for the benefit of all humankind. Closer to home, their work holds the promise of creating jobs and companies that could help Tucson transform its low-wage, service-dependent economy.

"There's a growing awareness that university research is good business," UA President Peter Likins said. "Entire industries have been created through research that was initially federally funded university research."

The UA is a world leader in optics and cancer research, but it has done a poor job overall bringing its ideas to market. It ranks 22nd in total research spending among U.S. universities - with $370 million in 2001 - but 78th in the amount it brings in from technologies licensed to startups or existing companies, according to an Arizona Daily Star analysis of data from the Association of University Technology Managers.

After years of missteps, and then inaction, the UA is jumping onto a bandwagon that, in Likins' view, started rolling 25 years ago. From the lessons other campuses have learned, plus interviews with people who turn ideas into companies, some key advice emerges for using technology to transform Tucson's economy:

State and local governments must spend more on university research, clear a path for fledgling companies to grow and for established companies to thrive, and help schools graduate students with the skills that high-tech employers demand.

Local businesses and investors must open their checkbooks to help launch promising firms, build the specialized office and lab space high-tech companies need, and invest in their employees' continued education.

The UA must attract and retain outstanding faculty able to draw top students and snare lucrative research grants, then team them with others who can develop marketable ideas.

Taking such steps could help create enough good jobs - $33,280-a- year medical manufacturers, $90,000-a-year optical scientists, and everything in between - to lift Tucson's $30,700-a-year average salary. The area's wages are lower than the state average of $33,400 and the national average of $36,200.

If it's ever going to happen, it's hard to imagine a better time than now.

The state soon will start construction on three research buildings where scientists can expand their discoveries. The UA is courting private support through endowments and commercial partners. And the university has committed more money and manpower to its technology transfer office, which scours the campus for ground- breaking ideas and helps spin them into companies through patents and licensing.

"I'm a firm believer that the universities are a huge economic driver," said J.P. Benedict, a senior in the Karl Eller Center's McGuire Entrepreneurship Program who is also the university's student body president.

The 21-year-old business student spent his summer studying potential tech transfer projects. He and his classmates will write a business plan for the most promising ideas, hoping to attract investors next spring.

"You see people coming out of the engineering programs and medical technology programs and they have these ideas," Benedict said, "but they don't know how to turn it into a profitable business."

Why do it?

The UA already is a powerful generator of jobs.

It is Tucson's largest employer with more than 11,000 full-time jobs. Research supported an additional 8,915 jobs and had a $387 million impact on the local and state economies last fiscal year, a UA study showed.

Spinning university technology into new companies could spread that wealth to every corner of the community.

One company could attract another, eventually building a community of similar firms - and their suppliers - that feed off each other's success. Some of those companies would stem from UA research; others would move here, eager to be part of the area's vibrant tech base.

An infusion of new tech companies could open a realm of opportunities to Tucsonans, nearly a quarter of whom work in retail and hospitality. The state's retail workers earn an average of $362 a week - less than $19,000 a year. The state doesn't track hospitality pay.

"The taxpayers put money in and I think we have a responsibility to try to put these technologies into the marketplace and create jobs," said David L. Day, who directs the University of Florida's Office of Technology Licensing. Florida is one of the nation's most successful tech transfer universities, thanks to home runs such as the sports drink Gatorade and a glaucoma drug sold by Merck, each of which generates millions for the school each year.

In the early stages, the benefits of tech transfer start with the university and flow outward. Eventually they flow both ways, said Steve Weathers, president and CEO of the Greater Tucson Economic Council. New jobs created from university research in optics, astronomy, biology and life sciences will attract top students to the UA, he said: "They are going to grow their own demand for students."

Those scholars could land lucrative jobs here after graduation, building a top-flight workforce that would attract even more companies to Tucson.

Student Ben Shepherd, for example, came to the UA to pursue his doctorate in physiology, drawn by the innovations and entrepreneurial spirit of Stuart Williams, the UA's director of biomedical engineering.

Shepherd, 26, leaves the UA this fall for a fellowship at Yale. He has a pending patent - jointly filed with Williams and associate professor Jay Hoying - on a technique for attaching new blood vessels to the heart.

Tucson, tech mecca

Ultimately, the UA's sharper focus on research and economic development will benefit students in the classroom as well as the laboratory, said professor Lay Gibson, director of the university's Economic Development Research Program.

"The people I know who are really good make an effort to be really good in everything they do - including their teaching," he said. "If you can take a course from someone who is internationally known and a real player, and the guy is also a terrific teacher, what could be better than that?"

Still, a fine balance must be struck, said Jory Hancock, UA's faculty chair and head of the dance division.

"In a large university like the UA, there are things that are important for their own sake, whether they generate money and boost the economy or not," Hancock said. "I hope that not every measure of success in education will be based on how it affects the economy."

The money can benefit the entire community, said Ross C. DeVol, director of regional economics for the Milken Institute, an economic think tank in Santa Monica, Calif.

"All of the nation's leading technology centers have universities that - to one extreme or another - heavily focused on commercializing their research," DeVol said.

GTEC's Weathers, who spent 11 years with San Diego's regional development group, said he sees Tucson where San Diego was about a decade ago.

San Diego is home to 500 biotech companies with $1.75 billion in revenues in 2000. Biotech employment there has more than doubled since 1991 to 32,350, according to San Diego's Chamber of Commerce.

Reformation of tech-transfer laws governing the University of California system, including UC-San Diego, was a key to the area's biotech success, Weathers said. Schools now can take ownership stakes in companies spun out of university research - letting them profit if the company takes off without sapping fledgling firms of much-needed startup cash.

"It was like a dam, and once it broke, the technology flowed," he said.

Arizona has the chance to do something similar next year, when voters decide on a constitutional amendment to let state universities own stock in startup companies.

Transferring technology

Improving tech transfer at the UA means turning around a long history of neglect.

Tech transfer took off after 1980, when Congress passed the Bayh- Dole Act, letting universities claim rights to inventions developed with federal money.

In 1981, the UA was issued its first patent - a system for removing solids from lime slurry used to scrub smokestack emissions. It opened its first tech-transfer office in 1988, to help researchers patent their ideas.

But it lacked money to help faculty members take their ideas to market. Patenting an invention can cost a few thousand dollars for a provisional application, or $20,000 or more for a full, 20-year patent.

"We had to find someone to license those technologies to or simply shelve it," said Mike Cusanovich, director of UA's Arizona Research Labs, who managed tech-transfer efforts from 1988 to 1990. "Tech transfer was at the very bottom of the food chain."

A costly lawsuit chilled early efforts to help faculty members start new companies. In 1994, the state and the UA paid $4.4 million to Gibson-Stephens Neuropharmaceuticals Inc. to settle charges the UA licensed the same drug technology twice.

The tide started to turn in 2000, when the UA got $300,000 from the state, county and city to expand tech transfer. The following year, the office secured annual sales tax money - $340,000 last fiscal year - from the voter-approved education initiative Proposition 301.

The UA also hired Patrick Jones, a former chemistry professor and licensing official at the University of Washington, to direct its tech-transfer office, and added marketing and licensing specialists.

Once a researcher discloses a potentially money-making idea, the tech transfer office helps apply for patents, and eventually negotiate licensing fees in the form of up-front payments or royalties on each sale. If the idea makes money, the UA shares in the profits.

The office's total annual budget, which also includes money from sponsored research, is now nearly $1.5 million, still just half that of Arizona State University. About $300,000 is for patent applications, compared with $1.5 million at ASU.

Even with more money, the UA still has a tall hill to climb: In 2001, it ranked 86th of 142 universities for U.S. patents issued - just eight, according to the Star analysis of the technology managers data. Five U.S. universities were issued more than 100 patents each that year, and the median for universities in the survey was 11.5 patents. The UA owns 99 patents.

The UA's push to boost tech transfer has won some allies among former critics. The university is not nearly as proprietary about technology developed on campus, local venture capitalist Larry Aldrich said. But Aldrich, a member of the UA's tech-transfer advisory board, remains concerned the school lacks the legal expertise to efficiently capitalize on the fruits of its research.

"There's still an overhang of that experience from years ago that says, 'Protect the university at all costs, don't let anyone get sued here,' " Aldrich said.

Historic groundbreaking

The completion of one of the nation's largest student unions this spring capped an era of student-focused investment at the UA. Now, with a groundbreaking on campus next month, the investment focus is shifting to research.

The Institute for Biomedical Science and Biotechnology, or IBSB, is about to begin its $65.7 million first phase. With 170,000 square feet, including 105,000 square feet of research space, it will house about 30 faculty scientists and another 300 researchers and support people.

The institute will be part of a biomedical corridor along Warren Avenue north of Speedway linking the main campus to the Arizona Health Sciences Center. Two other research centers, a $54.4 million Medical Research Building and the $30 million Roy P. Drachman Hall, will go up there in the next few years.

"If we're going to be players in the biotech industry, then we have to have those buildings," UA President Likins said.

The UA has at least one advantage over similar efforts: Its biotech institute will let researchers in various fields work side by side, allowing for unique collaborations. For example, a medical researcher and an optical scientist might team up on new ways to use light to detect cancer.

"That's unique in the country - I know no place where a plant genomicist is working in the same building, on the same floor, as the person dedicated to mammal immunology," said Dr. Fernando Martinez, director of the Arizona Respiratory Center and IBSB co- director.

Cramped quarters

An Arizona Board of Regents analysis five years ago showed research space was the UA's biggest need: Some faculty in the College of Medicine have worked out of temporary quarters for two decades, said Richard Powell, UA's vice president for research.

One of the biggest space crunches is in the UA's internationally known optics center. Today some of its researchers toil in unlikely places: optical detection workers in McKale Center, a laser expert in the economics building, and an off-campus remote sensing research group that has to drive to campus to teach.

Imagine Lute Olson trying to recruit a high school basketball star by promising terrific coaching, top-notch teammates - and a locker room in the economics building.

That's the challenge optics center director James Wyant faces when he recruits professors. One new researcher starts in December, making Wyant a bit nervous: "I promised her space and now I'm kind of worried about where I'm going to get the space."

There won't be room for everyone even after a $17 million expansion of the Meinel Optical Sciences Building is finished in December 2004. The building, along the UA Mall, will have 160,000 square feet - nearly 50,000 more than it has now - and ultimately could reach 250,000 square feet by adding two floors and expanding to the southwest.

The UA has allocated more money to biomedical expansion, but it actually has invested "fairly evenly" in optics, biotechnology, information technology and water and environmental research, Powell said: "We aren't trying to look dollars for dollars to make sure everything is exactly even," he said. "We're trying to meet the needs for those areas as they come up."

Meanwhile, other universities are making significant investments in optics, a field so integral to Tucson that Business Week magazine declared the area "Optics Valley" in 1992. The local industry boasts about 150 companies that employ 5,000 people and together bring in $650 million a year.

The University of Rochester, the only school other than UA with an optics doctoral program, plans a 100,000-square-foot building for optics and biomedical engineering. Georgia Tech, which is to start a $50 million research center next year, lured away a UA scientific team considered pioneers in an emerging area of optics and chemistry. One attraction was research space.

Future focus

Arizona State University President Michael Crow sees the state's universities as a vast, untapped economic resource.

"We are a state with great potential that has not yet exercised that potential," Crow said in an e-mail. "The university has a responsibility to position the state to be a part of the still- emerging, rapidly evolving, perpetually innovative, technology- driven economic change."

That's a new direction, but one Tucsonans should embrace, UA's Likins said. When he was a young engineering professor at UCLA, the public accepted the importance of universities without question. "That was a different America," he said. "We're in an America that demands accountability."

Technology transfer helps universities prove their worth, said Thomas Baldwin, the UA's head of biochemistry and molecular biophysics and founding director of the soon-to-be-built biotech institute.

The UA has long done well publishing its discoveries in scientific journals, Baldwin said. Now the tech-transfer office adds a new dimension, he said, teaming researchers with people who can get ideas to market.

"If we don't see a major change within the next decade, we're doing something really wrong," he said. "Now is the time."

FIVE RESEARCHERS TO WATCH

UA research accounts for 8,915 jobs and pumps $387 million into the economy. Here are some of the most promising practitioners:

Dr. Daniel Von Hoff

Age: 56

What he does: Directs the Arizona Health Sciences Center's new Cancer Therapeutics Program, and used to direct the Arizona Cancer Center. His research focus is pancreatic cancer.

What he could do: Help people survive a cancer that now kills all but 1 percent of its victims within five years of diagnosis. It will kill 500 people in Arizona this year.

Jennifer Barton

Age: 36

What she does: An associate professor in biomedical engineering, she uses light imaging to detect the earliest signs of cancer in tissue, specifically looking for skin and colon cancers.

What she could do: Early detection using optics technology would allow cancer to be removed before it becomes a threat.

Brian Anderson

Age: 33

What he does: An assistant professor of optical sciences and physics, he specializes in cold atom research. He is pioneering techniques for using light to manipulate matter, a reversal of the common role of using mirrors and lenses to manipulate light.

What he could do: His work could lead to breakthroughs in such areas as navigation techniques, timekeeping and measuring the strength of gravity, leading to advances such as probing for underground oil reserves without disturbing a rock.

Dr. Donata Vercelli

Age: 50

What she does: Assistant director of functional genomics at the Arizona Respiratory Center and a professor of cell biology, she researches genetic links to asthma.

What she could do: Understand why some people get asthma and what type of asthma they have, then devise individual treatments for patients based on their genetic profile. More than 80,000 children in Arizona have asthma.

Mo Ehsani

Age: 49

What he does: A professor of civil engineering and engineering mechanics, he uses paper-thin fiber-composite materials many times stronger than steel to strengthen buildings, bridges and infrastructure such as pipelines.

What he could do: Revolutionize the construction industry by extending the life of existing buildings without adding the bulk of concrete and steel.

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