

A Tiny Country's Big Success With Tech Transfer

Israel has long relied on brainpower to fuel economic growth, and its universities have been at the forefront of that drive

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Thirty years ago, two researchers at Hebrew University set about to make a better tomato. One that was firmer, stayed fresher longer, and could be harvested more easily.

Haim D. Rabinowitch and his doctoral supervisor, Nachum Kedar, genetically engineered such a seed in 1973, setting off a worldwide revolution in tomato cultivation. It also made their university a lot of money.

The technology-transfer arm of Hebrew University, known as Yissum, earned \$51-million last year in royalties, partly from the seeds it licenses to two Israeli companies. Those companies, Hazera and Zeraim Gedera, which were eventually sold to Vilmorin and Syngenta, also employ many graduates of the university's agricultural school.

The tomato-seed revolution, which has helped bring Hebrew University about \$1-billion, is not even Yissum's biggest moneymaker these days. Drugs for Alzheimer's disease and cancer also bring in millions, says Mr. Rabinowitch, who is now the university's rector.

This success story is hardly unique. Israel's seven research universities pioneered technology transfer years before the Bayh-Dole Act of 1980 permitted American universities to capitalize on their discoveries. Hebrew University founded Yissum in 1966, nine years after the Weizmann Institute of Science established its commercial arm, Yeda. Although the Weizmann Institute, one of the world's leading research centers, refuses to reveal Yeda's earnings, executives at other technology-transfer companies in Israel said its annual earnings are believed to be in excess of \$100-million.

Today, Yeda and Yissum are among the highest-earning university technology-transfer companies in the world. According to the annual licensing survey of such companies in the United States published by the Association of University Technology Managers, the

two would place in the top 10 if they were in the United States. That is an astonishing achievement for a country with a population of just seven million people.

Faculty members have also proved adept at patenting their research.

Nava Swersky Sofer, chief executive of Yissum, says that the number of patents per faculty member in Israel is more than double the average in the United States. She also notes that industry-sponsored university research is growing rapidly.

"We are seeing a lot more collaboration at all different levels," she says. "We try to foster relations at earlier stages, exposing academics to the needs of industry. Both sides benefit. Funding for higher education in Israel is dwindling, and industry provides an important source."

Today, she says, industry-sponsored research accounts for 10 percent of Hebrew University's net research spending.

But the impact of Israel's universities on the national economy goes far beyond research and commercialization of inventions. Fueled by a steady wave of university-educated entrepreneurs, the Israeli economy has become one of the fastest growing, most stable economies in the developed world.

In the past decade, Israel has emerged as a high-tech powerhouse, with more start-ups listed on Nasdaq than any country other than Canada and the United States.

Israel's gross domestic product has outstripped the average of the member countries of the Organization for Cooperation and Economic Development every year since 2002. It grew 5.4 percent in 2007, with much of that coming from high-tech exports.

"For a country with so many wars, Israel still has an economy with the power to astonish," *The Economist* reported in an April review marking Israel's 60th anniversary.

A National Transformation

Economists and academics say Israel, a country with few natural resources, has been able to leverage its brainpower by recognizing its importance early on.

"In the 1950s, this was the country of Jaffa oranges," says Dan Ben-David, a professor of public policy at Tel Aviv University. "Forty-eight percent of our entire exports were agricultural goods."

Today, Israel is a manufacturing-based economy dominated by high-tech industries. Israeli university graduates have given the world a range of innovations, including Intel microprocessors, the first worldwide Internet messaging service; and the security code that lies behind most of the world's computerized banking transactions.

Intel, Microsoft, IBM, and Google have major research-and-development centers in Israel. Academics say this results from Israeli universities' encouraging entrepreneurship and innovation.

At the Israel Institute of Technology — popularly known as the Haifa Technion — close relations between the faculty and industry have been developing for decades. IBM's first research-and-development center outside the United States was built on the Technion campus.

Other companies with a long history in the nearby industrial park include Philips Medical, General Electric, Hewlett-Packard, Tower Semiconductor, and the local defense giant Rafael.

Engineering students in their final year are encouraged to take on industry-oriented projects. Intel and IBM employ Technion undergraduates part time in their last two years of study.

"It's better than flipping hamburgers at McDonald's," says Moshe Eizenberg, executive vice president for research at the Technion. "We have established a center for entrepreneurship, we teach entrepreneurship as part of the students' courses, and we invite people who have been successful in industry to come and address the students."

The Technion's T³ project encourages faculty members to submit patent applications. About 100 applications were submitted this past academic year, up from fewer than 30 five years ago.

In the past, the Technion failed to capitalize on some faculty discoveries because the academics saw the problems they tackled as intellectual challenges to be solved, not as innovations to be sold, says Mr. Eizenberg. Despite the close ties with industry, the Technion earned only about \$10-million from royalties in 2007.

Mr. Eizenberg hopes that will change, following the opening in July 2007 of the Mann Institute for Research and Development in Biomedicine, which has a \$100-million endowment from the American philanthropist Alfred E. Mann.

"There is something we call 'Death Valley,' the period from the end of a science project until it becomes commercialized," Mr. Eizenberg says. "Until now, there has been no money from the university to invest in early-stage projects, which means that our eventual earnings are diluted by having to bring in investment partners. The Mann institute will invest in these products and bring them to maturity, enabling the Technion to enjoy the full benefit of the commercialization."

The Israeli army has also proved to be a vital source of technical innovation, with specialized units recruiting top students, pushing them through accelerated university training, and giving them sophisticated military assignments.

The founders of the computer-security pioneer Check Point all came from Unit 8200, a top-secret division of military intelligence where almost everyone has an undergraduate engineering degree. Talipot, another legendarily tight-lipped military program, propels its high-achieving teenagers through electronics, engineering, or physics degrees before turning them loose in state-of-the-art labs to invent next-generation defense solutions.

"The people coming from these units are both educated and have real-life experience. They are very useful to industry," says Yehuda Niv, chief executive of Tel Aviv University's Ramot at Tel Aviv Ltd., a technology-transfer company started in 1973, "Where else do 19-year-olds get to play with the most sophisticated computer systems on earth?"

Trouble Ahead?

While Israel's success with tech transfer and high-tech innovation is undisputed, some academics and industry officials see trouble ahead.

Israeli faculty members and students are locked in a long-running battle with the government over cuts in support for higher education, proposals for university reform, and plans to raise student fees. Since 2006, Israeli universities have been rocked by strikes by students and professors, and the key issues remain unresolved as the new academic year begins.

Hans A. Weidenmüller, a professor emeritus at the University of Heidelberg and director emeritus of the Max Planck Institute for Nuclear Physics, says that the "deterioration of the education and research systems" in Israel because of government budget cuts is "devastating" and "shocking."

In a letter sent to Israeli leaders in March, he warned that "technical support for experimental work has virtually disappeared."

"The consequences for Israel are bound to be disastrous. Without adequate infrastructure at the universities, the country will lose its position at the cutting edge of modern research," wrote Mr. Weidenmüller. "Without proper training of undergraduate and graduate students, the country will fail to produce the future generations of leading scientists. This will be detrimental not only for research but equally for high-tech industry and for defense."

Despite the doubts about education financing, Israel's technology-transfer companies show no signs of slowing down as new drugs and other discoveries have produced huge incomes.

At Yissum, the revenue from Haim Rabinowitch's tomatoes has been eclipsed by earnings for Exelon, the only drug on the market proven to slow down Alzheimer's disease. That produced sales of \$632-million in 2007. Yeda is earning undisclosed riches from its Copaxone treatment for multiple sclerosis. The Israel Institute of Technology at

Haifa is about to start enjoying royalties from Azilect, a drug developed there to combat Parkinson's disease. Ramot at Tel Aviv has its own Alzheimer's drug in clinical trials.

As the profits from these discoveries are plowed back into Israeli universities, the success of the country's technology-transfer sector seems assured.

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