



FOSTERING AN INNOVATION ECONOMY: LAUNCHING A TECHNOLOGY PARK, MEXICO, 2004–2010

SYNOPSIS

Beginning in 2004, the governor of Nuevo León, Mexico, set out to promote a high-tech knowledge economy and generate economic growth by bringing government, universities, and the private sector together to build a new technology park in Monterrey, the state's main city. Many countries had used tech parks to promote applied research that could generate new industries and expand economic opportunities. Because this US\$450-million project could generate benefits only in the medium to long term, the initiative required building trust in government, achieving broad consensus among a variety of institutions and interest groups, and creating a sustainable model to move the region's economy away from low-skilled manufacturing jobs and toward high-value, specialized industries. Nuevo León's governor partnered with Jaime Parada at Mexico's National Council of Science and Technology to mobilize support, raise funds, devise incentives to attract tenants, and set up governance structures. By 2013, the park housed 35 research facilities, had created more than 1,500 high-skilled jobs, and was expanding onto additional land to serve a waiting list of tenants.

SPOTLIGHT: This case also features an initiative by Tecnológico de Monterrey, Mexico's largest private university, to create several technology parks of its own. The two experiences highlighted some of the design and implementation challenges countries commonly encounter when they try to develop and diversify their economies.

ISS staff members drafted this case study based on interviews conducted in Monterrey and Mexico City, Mexico, by Anna Levy in August and November 2013 and by Ariana Markowitz in November 2014. Case published July 2015.

INTRODUCTION

In 2003 Jaime Parada sat down to persuade the most-important business, university, and local government leaders in Monterrey, Mexico, to invest in the city's first technology and innovation park. He faced a skeptical audience. Earlier in that year, Parada had joined Nuevo León governor José Natividad González Parás in an effort to make the state's major city, Monterrey, a knowledge city that could move the regional economy from basic

manufacturing to high-value industries. One way to help build a knowledge city was to develop a technology park. A tech park had the potential to promote collaboration between researchers and entrepreneurs, spur innovation, and generate economic growth. But the park would require big up-front funding commitments and strong project management to bring about benefits that might not materialize for decades. Parada had to make a credible case for success.

Monterrey proudly considered itself the industrial capital of Mexico. The city's 4.3 million inhabitants, who had a national reputation as hardworking, savvy *regiomontaños* (mountain people), made up only 4% of the national population but produced 11% of Mexican manufactured goods and had a per capita income of just over \$16,000 in 2007—double the national average.¹ The Monterrey area housed some of the country's industrial and commercial giants, including Cemex, the world's third-largest cement company; FEMSA, Latin America's largest bottling manufacturer and supplier; Banorte, a leader in the Mexican banking sector; and Grupo Alfa, whose core businesses ranged from petrochemicals to automotive parts.² The business community benefited from Monterrey's location just two hours south of the US border by automobile. And since the North American Free Trade Agreement had come into effect in 1994, international companies had begun to make the

city a low-cost manufacturing base for the North American market.

Nuevo León's strong university base, with four of the country's highest-ranked public and private universities based in Monterrey, ensured a steady stream of highly trained human capital—people with the skills industry needed.

An engineer by training, Parada had extensive experience in leading technology efforts at some of Mexico's largest businesses.³ His work had taught him that science and technology were crucial in order to remain competitive. "Suddenly, we [Mexico] entered into globalization," he recalled. "That implied very important changes in our economy, in our business, in our academic sector, and in our political class. We recognized that if Mexico was no longer competitive based on natural resources or cheap labor . . . knowledge appeared to be a very strategic component."

Parada envisioned Monterrey as an anchor for developing the region's technology- and

Box 1

Collaboration at Work: Saving the Avocado Export Industry

To Jaime Parada, the benefits of clustering universities, entrepreneurs, existing businesses, and support services were clearly visible. He recalled an incident that had provoked his interest. In the early 1990s, Mexico was the world's largest producer of avocados, but it was not permitted to export avocados to the neighboring United States. The US Department of Agriculture had long banned imports because it believed the avocados harbored a destructive fruit fly that could threaten crops.

In 1992, a group of entomologists—insect scientists—launched a test to identify the conditions under which the avocado transmitted the insect. They dissected 153.5 tons of avocado fruit drawn randomly from nine warehouses and found no infestations. They discovered that the flies did lay eggs in the fruit but that the Hass variety of avocado had a natural resistance that reduced the viability of the fly eggs. After the fruit was picked, that natural protection diminished rapidly, but careful sanitation practices and cold temperatures could reduce the threat of transmission at that stage. On the basis of that

evidence, in January 1997 the United States permitted imports of avocados from the Mexican state of Michoacán to 19 states in cold-weather months, and Mexico's total exports of avocados rose by about 19% as a result. Gradually, the US and Mexican governments worked with Mexico's avocado producers to create a system of sanitation practices, spot checks, and shipping methods that would reduce the likelihood that the fruit would become a vector for the fly; and Mexico won the right to export to additional US states.

Parada said, "I ran the numbers on the cost benefit of this group of entomologists. They cost a small amount, and the impact of their knowledge had huge benefits for this very important economic issue."

Sources: "Importation of 'Hass' Avocado Fruit (*Persea Americana* cv. Hass) from Mexico: A Risk Assessment," U.S. Department of Agriculture, June 2003, *passim*. "Avocado Situation in Selected Countries," FASOnline, <http://www.fas.usda.gov/ftp2/circular/1998/98-02/avo98fea.html>. Serrano, Raúl and Estrada, Adriana. Pruebas Científicas Derribaron Barrera Sanitaria de EU al Aguacate Michoacano. Investigación y Desarrollo. Feb 28, 2013.

innovation-based sectors, moving past cheap labor as the primary source of growth and helping retain the country's highly educated residents, many of whom were moving abroad. In 2000, more than 2.5 million Mexicans with secondary education or higher worked overseas.⁴

As executive director of the Mexican government's National Council of Science and Technology (Consejo Nacional de Ciencia y Tecnología, or CONACYT) since 2001, Parada had started a variety of programs that matched federal funds with state-level investment to promote industrial innovation. In 2002, he had helped pass the Law on Science and Technology, which increased federal spending on science and technology.

Parada had proposed the idea of starting a technology park in Nuevo León when Governor González Parás, a member of the Institutional Revolutionary Party (PRI), was elected in 2003. With the governor's strong support, Parada worked to turn that vision into a reality that would bring tangible benefits to Monterrey and to the state.

THE CHALLENGE

Early in his term as governor, González Parás consulted with Monterrey's business leaders and CONACYT about how to make the state capital a knowledge city and stimulate economic growth. The knowledge city idea had six key elements: redesign primary and secondary education curricula, bring new research centers and technology-based companies to the city, promote innovation in existing supply chains, stimulate entrepreneurship, promote a culture that would support invention and growing technological sophistication, and create the urban infrastructure needed to support those activities. Parada's recommendation to create a tech park could help fulfill at least the first five of the six goals, and it became a centerpiece of the knowledge city plan.

The basic idea behind a technology park was

to invite companies and universities to locate in one place and to stimulate interaction among them so as to trigger ideas, generate experimentation, and build new enterprises. The companies could show the researchers some of the scientific problems they faced and initiate new streams of inquiry. Entrepreneurs might translate university researchers' ideas into practical applications. And as understanding of the skill needs of private companies grew, universities could introduce new courses that would train students more effectively for available jobs. Moreover, companies could interact more easily with each other and join forces to handle different parts of the production process. The experiences of other countries suggested that well-managed parks could generate new patents, increase the value of products and services for export, expand the number and type of knowledge sector jobs available domestically, and spur the creation of specialized technical education programs at universities.⁵

The role of government was to help bring together companies and educational institutions whose expertise and needs complemented each other and whose activities built on a region's comparative advantage. In other countries, governments often provided the necessary land, changed rules to facilitate cooperation, and offered support services.

Creating a new technology park would not be easy. The initiative would require hundreds of millions of dollars in start-up funds, and it was unclear whether the project would generate sufficient economic benefit to justify the infrastructure costs. Moreover, the greatest returns on investment lay two or three decades in the future—if international experience was any indication—because of the time required for scientists and engineers to run experiments and develop applications. Even though Governor González Parás knew that spending money on long-term science and technology efforts rather

than on immediate basic services such as education and roads could hurt him politically, he said that fostering long-term economic growth was important for supporting “future generations, and not just future elections.”

Although the governor’s personal involvement in the project would be crucial to getting the park off the ground, that involvement could also be a liability. Businesses and universities were suspicious of the government’s role—both because of the risk of corruption associated with any big infrastructure project and because of skepticism about the ability of successive governors to sustain support through several electoral periods. Further, expanding support for the park required overcoming partisanship—even in Monterrey, which had a reputation for pragmatism. Many residents of Nuevo León had backed the pro-business National Action Party (PAN) and had helped elect the first PAN president in 2000, ending 70 years of one-party rule by the PRI in Mexico. Allied with the Green Party, the PRI had regained control of the state in 2003. Political tension bred distrust, thereby complicating efforts to make expensive, long-term investments.

Even if he and his staff could raise the money to build the park, Parada faced a long list of other challenges. First, he would need to create an organizational structure that would permit the state government to implement its vision while giving the park the independence to gain investors’ confidence and to sustain itself long after Governor González Parás left office.

Next, Parada and his team would have to come up with the right mix of incentives to attract paying tenants to fill the park—from international businesses and high-tech entrepreneurs to universities and research centers.

After the tenants joined the park, the management team would have to ensure that the tenants would actually collaborate and create knowledge economy jobs. There was always the

risk that unrelated companies would move in and treat the facility merely as a source of subsidized real estate. And that risk would be greater than it was in other countries because Mexico did not have a history of university–industry collaboration.

“At the beginning, when the administration started, . . . there were no connections between the business community and the academic and research community,” Parada said. “The politicians—I mean, the president, the ministries, the governors—didn’t understand the impact and importance of research and development for the economic and social problems that Mexico was facing.”

However, González Parás said he found Parada’s proposal compelling because Monterrey had the right mix of a strong public sector, sophisticated universities, and highly trained human capital to make it a success. “These types of projects are not just for anywhere,” the governor said. “There needs to be a decent urban and academic infrastructure in place. The region also needs to have specific sociogeographic and economic characteristics for these strategic sectors to make sense.”

FRAMING A RESPONSE

In 2004, González Parás began to assemble a team that could turn the tech park vision into reality. As the initial visionary at CONACYT, Parada started as an adviser to the governor and eventually became the park’s executive director. He hired Martha Leal, a native of Monterrey, to help with fund-raising and to coordinate efforts at the federal level. To improve credibility and bring in investors, González Parás wanted people with private sector experience. After consulting with business leaders, he brought on Antonio Zárate, a former chief executive of Metalsa, a London-based transportation company. Zárate recruited his former Metalsa colleague Reynold González Lozano to take charge of the park’s day-to-day operations.

The new team outlined the park's vision: "(1) to increase the state's GDP per capita from US\$15,975 to US\$35,000 by 2020; (2) to become one of the world's 25 most competitive regions; (3) to consolidate a world-class education, research, and innovation system; (4) to demonstrate to the regional population the importance of education, knowledge, R&D, and innovation in their lives."⁶ The park's primary objectives would be to promote applied research, link research to industry needs, cultivate Nuevo León's intellectual capital, and incubate new, innovation-based businesses.⁷ With that vision sketched out, Parada, Leal, Zárate, and González convened a planning committee of 12 to 14 key decision makers from government, academia, and the private sector. The committee comprised representatives of several universities, the state secretary of the economy, Monterrey's software businesses, and CONACYT.

For Parada, reaching agreement with all likely stakeholders required a thorough explanation of the project's value to each of them. "If the politicians didn't understand that knowledge, research, and development added value, they lost interest immediately," he said. "So we tried to find a good value proposal for the academic sector, a good value proposal for the business sector, and a good value proposal for the politicians, the governors, the communities, and the states." The planning committee gave informal consent to the idea and agreed to help mobilize support across sectors. The committee continued to brainstorm ideas throughout 2004 and 2005.

To begin translating the governor's vision into a plan of action, Zárate and González traveled to several countries to learn how existing tech parks worked. They visited Research Triangle Park in North Carolina, Silicon Valley in California, and Boston's Route 128 in the United States along with technology parks in Canada, France, China, and South Korea. They surveyed models, financial plans, economic development

capabilities, and management structures. These visits revealed a range of options as well as insights about several hurdles the team might face. A plan began to emerge (Figure 1).

GETTING DOWN TO WORK

The tech park team had to pursue several tasks at once. Extensive funding commitments were needed to cover the initial infrastructure costs, which were estimated at approximately US\$145 million.⁸ Second, the team had to choose a governance structure to separate the park from politics and set it on a path to long-term sustainability. Good governance was essential for securing the necessary financial backing. A third priority was to foster the kind of collaboration that would help generate innovation and economic growth. It put some of these ideas in place and devised new strategies as well.

Finding a home

The search for a location began in earnest in 2004 and continued for nearly two years in tandem with tenant solicitation, governance decisions, and infrastructure planning. The governor had taken the lead in finding space. Initially he had set his sights on an area along the Sierra Madre mountain range. After nearly two years of fruitless negotiations, however, he drew from state funds to purchase 70 hectares from one of the participating universities: Monterrey Institute of Technology and Higher Education (Instituto Tecnológico y de Estudios Superiores de Monterrey), known as Tec de Monterrey, in Apodaca municipality, on the outskirts of the city. The land deal finally materialized in 2006.

Apodaca was near the airport, which made the park accessible to international visitors and investors, a strategic lesson learned from overseas examples. The location also was outside areas that had experienced the worst violence during a government crackdown on drug cartels, although it was nearby. However, there was a downside: the

site was a 25-minute commute from downtown Monterrey, where most campuses were located.

Establishing a governance structure

To secure funding, the planning team had to answer questions about the park’s legal and institutional structure and its relationship to the government.

In 2005, the governor created the Institute for Innovation and Technology Transfer (Instituto de Innovación y Transferencia de Tecnología) to implement his Knowledge City plans. As a semiautonomous state agency, the institute retained overall authority over the park’s strategy and operations and could enter into agreements with foreign companies and universities. As the institute’s first director, Zárate reported directly to the governor and joined the state government’s extended cabinet—albeit without a ministerial title. González became the functional

infrastructure and project manager for all aspects of park planning, reporting directly to both the governor and Parada.

For the park itself, the original planning committee of 12 to 14 of the city’s leaders proposed setting up a private trust, or *fideicomiso*. Under the terms, tenants that moved into the park became members of the trust. They would finance their own operations and research facilities by using public subsidies and grants as well as their own resources, and they would agree to build their facilities within two years. They would assume responsibility for ensuring that the park’s activities were restricted to research and development related to technology or to innovation. Tenants were permitted neither to sublet their space nor to use the facilities to manufacture products. “The land couldn’t be assigned to any other purpose besides innovation, development, or education,” Zárate said.

Figure 1
Timeline: Park for Research and Technology Innovation

Conceptualization 2005–2007	Development 2008–2011	Deployment 2012–2015	Maturation 2015–2020
Consensus on vision and signed tenant agreements	Creation of physical infrastructure and construction of research centers	International networks and virtual research and development centers	Serve as a base model for creating regional technology parks
Structure, planning, and business model in place	Alliances on a global level	Innovation consortia	Value-chain promotion and ecosystem production
Attract strategic companies	University–industry linkages in place	Creation of new research centers	Produce emerging global companies
Attract public and private research centers	Scientific and technological interactions with the city’s strategic clusters	Development of new strategic industries	
	Define indicators and evaluating performance		
	Launch biotechnology and nanotechnology incubators		

Source: Parque de Investigación e Innovación Tecnológica, Monterrey, Nuevo León; Instituto de Innovación y Transferencia de Tecnología de Nuevo León, 2010, p. 64.

The trust established governance protocols that included fixed presidential terms, a system of elections, and a set number of annual meetings. Tenants would pay fees to a common fund managed by the trust to cover collective expenses, including the salaries of some of the park's small staff. When policy decisions arose, each member held a single vote; the Institute for Innovation and Technology Transfer held four. By design, this structure ensured more influence for the institute in the park's affairs during the early years—and less later on. As new tenants joined the park and the trust, the institute's four seats on the trust's governing council dwindled in influence.

Establishing the trust helped assure investors of the park's independence and long-term viability. As Parada explained, “By law, we have a mandate to follow through on a 25-year plan.”

With the trust in place, in June 2005 academic and government leaders formally created Innovation and Technology Research Park (Parque de Investigación e Innovación Tecnológica, or PIIT). The PIIT signatories included the president of Tec de Monterrey, the secretary of research and innovation at the Autonomous University of Nuevo León, the high director of the University of Monterrey, CONACYT reps, the governor of the state of Nuevo León, the head of the Corporation of Strategic Projects—formed in 2003 to support the Knowledge City initiative and four other projects—and representatives from the institute.⁹

The institute managed the park's strategy, while the trust handled its day-to-day governance. As PIIT evolved, the leadership created subcommittees to cover finance, transportation, and security. Each subcommittee included some tenants and at least one representative from the institute so as to enable information to circulate to all relevant managers and stakeholders.

Mobilizing support and financial resources

In 2005, the tech park team launched its

campaign for public investment. Earning government support was a critical first step. In other countries, heavy public investment helped reduce the risks private investors and universities faced in cultivating new high-tech industries.¹⁰ Governments could provide resources to enterprises within those nascent industries through grants, tax incentives, and policies, such as subsidized access to land.¹¹

But international examples had shown that winning legislative backing for these funding commitments often hinged on the promise of substantial private or foreign direct investment, as well as measurable economic multiplier effects or indirect benefits that were likely to flow from those funds.¹² So the team first presented the idea to the city's group of 10—the 10 most important businesses in Nuevo León. Without the informal endorsement of those 10 industry leaders and access to their networks, the initiation of ambitious economic or private sector development plans in Monterrey would have been very difficult.

Drawing on international examples, the team showed how collocation of companies and universities, facilitated by government, could produce benefits that exceeded what individual companies could generate by themselves, including increasing the values of products for export, boosting local knowledge capabilities, and stimulating new degree programs at universities.¹³

With the group of 10's support, Zárate worked closely with the governor to secure public financing and made presentations to Nuevo León's Congress in 2004 and 2005. At the state level, González Parás's party influence helped. “We had an advantage because in the first three years of my administration, my party had the majority in Congress. At the beginning, it was really important,” said the governor, who backed the park project emphatically.

Even with the governor's strong backing, Zárate knew that winning a major financial commitment from the state would be challenging.

Persuading legislators to fund the initial investment depended on (1) presenting detailed information about Monterrey's comparative advantage in Mexico and the park's potential contribution to the region's knowledge economy and (2) promising that federal and private funds would augment state resources.

According to Leal, the project would be a hard sell because "If you have bigger problems in health or education or security, it is very common to think, 'I will attend to those first,' instead of thinking that if you support science and technology in those areas, you will have long-term solutions to the problems" that cause poor health or insecurity. "It is not something that politicians would choose at first sight. We have to work hard to demonstrate the usefulness of applied science and technology."

Zárate and his staff prepared comparative international data, highlighting the sequencing of public and private sector investments and the relationship of those expenditures to outcomes. "We showed them what South Korea did, what Finland was doing, or the United States or Canada," Leal said. The private sector had invested in science and technology development in each of those countries.

Although the state and federal governments committed US\$250 million to the project for the period 2006–09, political shifts complicated the disbursement. The original financial package won approval while the governor's political party, the PRI, held power. However, "After US\$50 million was committed, there were negotiations around the public budget," Zárate said. "In 2006, the PAN took power in the Congress, and this made it more difficult to get the rest of the money." The initial tranche of government funds covered the US\$10-million purchase price for the land; the institute's expenditures; the park's physical infrastructure, electricity, and water systems; and subsidies to the initial tenants for building their own research facilities.

During the next few years, the team found additional funding sources. In 2009, CONACYT set aside resources for which state agencies and park tenants could compete. Several park tenants took advantage of those opportunities, which supported high-value-added businesses, technological innovation and competitiveness, and development and innovation in cutting-edge technologies. The same year, the state legislature created the new Nuevo León Fund for Innovation, which received funding from both CONACYT and the Inter-American Development Bank.¹⁴

Attracting tenants

The search for tenants overlapped decisions about governance structure, because the first tenants would also be the first trustees and could shape policy in that role. Beginning in 2005, Parada and Zárate led the campaign to find tenants among research centers, universities, and businesses. They continued to recruit new organizations for several years, prioritizing those that could contribute most effectively to the park's planned knowledge sectors: biotechnology, health sciences, mechatronics, nanotechnology, and information technology (IT).¹⁵

Enlisting universities could be difficult, because educational institutions usually had lengthy clearance processes for new projects. As a result, Parada and Zárate initially reached out to publicly funded research centers, which had more-flexible funding and could commit more easily. Joining the park would bring them lucrative opportunities for private research contracts with other tenants. Parada drew on his connections at CONACYT—which had 27 research centers across the country—and the park received its first commitments from two large centers in 2006. Next, Parada and Zárate focused their attention on universities, which could offer the park built-in research capabilities and a continuous supply of highly skilled human capital.

Experiences in other countries showed that tech park membership could boost university quality. For example, it could help streamline patent development, increase the ability to recruit and retain leading scientists, improve the ability of university faculty members to develop and publish research, and attract a broader range of public grants and private investments.¹⁶ The institute highlighted these benefits and prepared studies that identified resource and equipment gaps in university research facilities and showed ways that membership in the park could help alleviate those problems. The institute also pitched opportunities for practical student engagement, independent consulting contracts for faculty, and increased global recognition.

To further encourage university interest, the state offered matching funds for activities linked to the park's mission, and the governor's office made some contributions to university budgets contingent on a school's participation in the park. By 2008, the park had persuaded six universities and publicly funded research centers to join its roster of tenants, but no multinational or domestic companies had yet confirmed that they would participate. Private firms wanted to see how existing tenants' research activities developed before making final investment decisions.

Parada said the main obstacle at the time was getting the private sector to believe "that this park would actually be a place for innovation." He reasoned it would be easier to persuade domestic companies to join if prominent multinationals already had a presence, so he targeted multinationals first.

The institute offered business and research support services, grants, and other financing opportunities. "The most important ingredient was not the money or the land but the resources available in the research centers, metrology labs [which focus on measurement], equipment, and human capital," he said.

It took years to finalize private sector commitments. The first two companies, Motorola and PepsiCo, signed contracts in 2008–09 and began building research and development facilities shortly thereafter. Motorola established a center for engineering and design, which started in 2009. PepsiCo's Global Center for Innovation in Baking and Nutrition began operation in 2011. Other companies followed.

The original vision for the park had included a focus on small and medium-size enterprises and entrepreneurs. The institute created a Monterrey software and IT cluster that consisted of 40 small and medium-size technology-related enterprises. Members of the cluster formed a legal trust of their own and began construction of a collectively sponsored research facility with space for 1,200 people. Each company in the cluster purchased the amount of space it needed. By joining together, the companies also found they could negotiate larger international contracts.

In looking for tenants, the institute also had to gauge the financial capacity to pay for facility construction, utilities, business development services, and the use of shared equipment. By 2009, more than 80% of the park's space had been allotted to tenants; the first research facilities were completed; and the rest of the park was under construction.

Fostering collaboration and providing support

Collaboration among tenants, which was crucial to the success of the park, depended on more than physical proximity. An atmosphere of cooperation had to be cultivated through design, incentives, and active coordination. The institute hired a part-time architect to work with the park's engineer to design a space that was inviting as well as conducive to information sharing and teamwork. Parkwide wireless Internet access increased workplace flexibility. And the designers also planned a commercial plaza with services, a nursery, a laundromat, and an office-supply store.

One way a park could help its members was to enable organizations to share expensive equipment—thus realizing economies of scale. To facilitate that kind of cooperation, the planning committee drafted cost-sharing guidelines and scrutinized budgets to try to identify potential savings that tenants could realize through rental arrangements. Initially, tenants continued to purchase their own equipment, however.

Other types of financial incentives proved more effective for generating synergies. The institute supported university course development to build students' and park tenants' technical capacities, and it helped assemble legal expertise for patent applications. The institute also underwrote grants and venture capital funds linked to university-business partnerships or entrepreneurship schemes. At the same time, CONACYT started to require that universities and businesses team up to apply for the research grants it sponsored. The two organizations also developed guidelines for shared project development and funding to help clarify assignment of intellectual property rights prior to collaboration.

The institute created ways for tenants to exchange information about their needs and discover opportunities to work together. In 2007, the institute initiated monthly check-in meetings with tenants to announce updates on administration, construction, progress indicators, and services. The meetings evolved into informal venues for exchanging start-up notes and learning about other tenants' activities. By 2010, the institute had also installed a basic intranet system to enable tenants to list research services and project tenders.

OVERCOMING OBSTACLES

From 2006 to 2010, the park's operation matured significantly, and its landscape started to resemble a micro business district that was under constant construction.

Parada took over Zárate's position as executive director and became the public face of the park. González oversaw the park's operations and continued to serve as a liaison between the trust and the institute.

But even as the park began to fill with tenants, Parada and the institute faced unexpected challenges. Drug cartels had long used Mexico as a transit route for moving cocaine, marijuana, and heroin to North America, and competition among them had sparked widespread violence. In the mid-1990s, enforcement had helped reduce drug-related homicides and violence, but 2005–06 saw signs of resurgence. In 2006, Mexico's government deployed troops to crack down on the trade. Within months, clashes among new rival drug cartels bloodied Monterrey's streets. In 2007, the US State Department issued a warning for people traveling to Nuevo León.¹⁷ Kidnappings escalated and the murder rate increased by almost 300% from 2010 to 2011.¹⁸

The institute worried that escalating violence would damage international interest in the park. Although the park's location in Apodaca, on the outskirts of the city, buffered its facilities and staff from much of the trouble, kidnappings remained a concern. Parada said: "There were no incidents in the PIIT or surrounding areas during that time. We were more than 2 million people in Monterrey, and we never had to interrupt our work for security issues." He added, "The only precaution we took as a government was to issue a notice in the most difficult areas and a security alert not to travel around the city late at night."

The political context also shifted. González Parás's ardent support for the park had provided the initial political and financial support to get the project off the ground. But as crime rates rose and skepticism grew about the governor's affinity for megaprojects, the governor's public opinion ratings fell, and the park, which was closely linked to his grand plans for a Knowledge City, found its image tarnished.

The institute responded with awareness campaigns and park tours to help businesses form opinions based on evidence rather than political perceptions.

González recalled one memorable example: “We were visiting the largest companies, the very top companies here in Monterrey, the big ones. I remember telling them about the project, and one of those big companies’ top executives told me: ‘We don’t believe in that project, in the PIIT. We don’t believe in that project because it is a white elephant.’ I asked him, ‘Have you been there?’ He said, ‘No, but that’s what everybody says.’ So that kind of shocked me. I told this guy, ‘Give me a couple of hours anytime you want. I’ll take you to the park, and I would like to hear your opinion after that.’ So we did; he agreed.” That company visited, saw the logic, and invested, González said.

ASSESSING RESULTS

During the park’s early years, evaluating its performance proved more challenging than expected. The institute wanted to show advances in tenant research output and business development, higher education and postgraduate promotion, and the park’s overall contribution to the local economy and the region’s knowledge economy. Institute staff created indicators to track the ratio of public-to-private investment as well as the number of high-paying jobs generated by or through the park’s activities, the number of scientific papers published, projects jointly executed by universities and businesses, new innovation-based businesses created, new graduate programs launched, and science and technology awareness events held. Tenant-specific measures drew on progress indicators related to business development, total monetary value of research, or number of new patent applications generated.

Tracking innovation-related activities was difficult, however, because companies wanted to protect proprietary information. As Leal recalled: “The private [companies] tell us, ‘No, I can’t tell

you what I am working on exactly. I can give you an idea of the research areas, but I cannot be very specific on the lines of research and the results.”

The institute simplified reporting expectations and used the monthly coordination meetings as venues for documenting tenant activities. Tenants reported general progress updates on infrastructure, implementation, research, and new staff. In 2008, the institute asked tenants to submit semiannual reports stating the total monetary value of their research and project portfolios. The park’s staff often visited tenants in person to collect metrics. The data fed into efforts to attract additional tenants and improve business and public opinion of the park by sharing its economic benefits.

The benefits gradually began to materialize. According to the 15-year strategic work plan laid out in 2005, the park achieved most of its own objectives on time. Of the total US\$450 million of accumulated investment in park infrastructure, including tenant research facilities, public investment totaled \$150 million and private investment totaled \$300 million—a two-to-one ratio of public-to-private funds.

Parada’s recruitment efforts generated a waiting list of new tenants, and in 2010 the government transferred for development an additional 40 hectares on the periphery of the park. By 2013, Mexico’s first tech park had seeded an empty 173-acre plot of land on the outskirts of Monterrey with 34 universities, businesses, and publicly funded research centers—of which 10 were still under construction and 24 were operational. One was a software cluster of 40 small firms that shared the same building. The park facilitated greater communication between academia and industry, supported industry growth in specialized science and technology sectors, and garnered hundreds of millions of dollars in public and private investment.

The interaction within the park produced about 50 new products and processes per year,

including patents for an antibacterial bathroom floor covering and antiultraviolet particles for use in cosmetics and paints.

The park stimulated a new category of high-skilled employment. By 2013, 2,300 people held jobs with park tenants or their offshoots, and the institute projected that employment would reach 6,500 by late 2015. The park had successfully increased collaboration and partnership between industry and academia, and the number of joint academic–business proposals had increased from 50 in 2006 to more than 200 by 2012.¹⁹

The staff also tried to quantify broader returns on investment at the city and state levels by focusing on increases in jobs and the anticipated multiplier effects of some of the park’s activities. The park also helped spark the creation of InnoVA City, a planned development that would include residential and commercial zones for researchers, executives, and their families.

REFLECTIONS

Asked what the implementation team might do differently if it had the chance—and what others could learn—González suggested that adding a manufacturing component could enhance the ability to gauge results and increase the appeal of the park to the broader public.

The institute had ruled out manufacturing from the start in order to prevent misuse of the park’s facilities. It wanted to avoid subsidizing production and to focus its resources on research and innovation. As a result, the number of high-skilled jobs did not translate easily into quantifiable economic gains or a reliable source of employment for the wider public in the near term. “It’s hard to measure the benefits of the PIIT because of the model; there is only research and no manufacturing activities,” González explained.

Innovation and high-tech sectors had much

longer maturation times than traditional manufacturing in industrial parks. Most international research parks included some manufacturing components to help local governments and communities see the effect on the local economy. In other parks González studied, “The multiplier effect for the economy in general was around 8 or 9, speaking of job creation.”

González further emphasized the importance of predictable revenue streams from the beginning. Carefully selected manufacturing could offset budgetary uncertainties and lay the groundwork for a financially self-sustaining business model.

The park team had hoped the park would lead to social benefits as well. Parada had originally stated that the technology park was not only “for the creation of state-of-the-art knowledge but also for transformation of the knowledge for the benefit of the entire society, for the economic sector, and also to solve social problems.” However, social goals had to be built into the planning and into the park’s metrics from the very beginning—in the managers’ view; otherwise, they received less attention.

Still, the park demonstrated that the “triple-helix approach,” which rested on cooperation among academia, government, and private sector, could succeed. By 2013, midway through its strategic work plan, the tech park had met and surpassed timeline benchmarks set by similar parks internationally.

Parada took pride in the park’s accelerated pace of development. “I visited some research parks in other parts of the world that took 15, 20, 30 years,” he said. “Suddenly, we were very surprised that this project took just seven years in order to be completed from the idea to the 35 research centers that we have there.”

SPOTLIGHT

TECNOLÓGICO DE MONTERREY TECHNOLOGY PARK INITIATIVE

From 2004 to 2015, the Mexican government's ambition to diversify the economy and increase the number of higher-wage jobs helped inspire several other efforts to bring universities, government, and business together. At the same time that the state of Nuevo León launched its Monterrey Knowledge City program, the Monterrey Institute of Technology and Higher Education (Instituto Tecnológico y de Estudios Superiores de Monterrey), known as Tec de Monterrey, created a technology park at its Monterrey campus—the first in a network throughout the country. Of 21 Tec de Monterrey collaboration experiments, 5 showed strong signs of success by 2013. The Tec program faced some of the same core challenges PIIT had encountered. Those challenges spurred further learning about how to use collaboration to promote economic development.

The link between PIIT and the Tec experiments was Arturo Molina Gutiérrez, a computer scientist who had become dean of the School of Engineering and later rose to become the university's vice president. Molina took seriously the Mexican government's concern for improving labor productivity, raising incomes, and diversifying the country's economy. In his view, Tec could serve an important role in building the strength of the Mexican economy. It was the largest private university in the country, with 31 campuses and more than 90,000 students. Tec also had strong ties with the business community, and its emphasis on active learning created an opportunity to forge the specific kinds of partnerships new national policies encouraged.

The question Molina faced in his leadership roles at Tec—as director of the Ciudad de Mexico

campus, rector of Mexico City campuses, dean of engineering and architecture at Monterrey, and vice-president for research, graduate studies and continuing education—was how best to create a virtuous circle that linked research and training to business development and job creation.

Framing a response

The first conversations took place in 2000–2001, when the university began to create business incubators on its campuses, according to Luis Miguel Beristain, a Tec professor involved in the university's entrepreneurship program since the 1990s and a leader at the Ciudad de México life sciences campus.

Molina wanted to go beyond a simple incubator concept. He sought to link education and business in new ways. In the words of Carlos Ibarra, a professor who became director of the Querétaro (Monterrey) park in 2014, the aim was to create “an ecosystem of entrepreneurship”: networks and opportunities for students and a source of skill and insight for corporations.

Molina appointed Monica Breceda, who had a background in entrepreneurship and engineering, to manage day-to-day planning. The two toured technology parks in China, India, Spain, and the United States. They decided that the University of California, San Diego, Science Research Park and the University of Barcelona offered promising models in which the university built lab facilities and shared access with companies and with its researchers. Molina and Breceda first wanted to create an innovation center in Monterrey to provide proof of concept and then expand the model to Tec's other campuses.

During 2004 and 2005, Tec began to construct a facility on the edge of its Monterrey campus in an old shopping mall to help develop small, high-technology, high-value companies that were in the idea phase and needed help with patenting, scaling up, or marketing. The main requirement for private sector participation was that a company had to have a high-value technology product.

Financial support came from the university—which covered the cost of the infrastructure—and from government grants for small and medium-size enterprises. Breceda assembled support services to help tenants with legal contracts and immigration services and devised a plan to bring companies to the campus and link them with researchers and students.

Breceda said the planners encountered early problems. “The dream didn’t quite fit with the reality” at first, she said. The project was understaffed. It was hard to work out agreements with the university because the building was outside the campus and the university did not want to extend security and other services off campus. It also was important for the tenants to have access at all times, and an around-the-clock-access policy departed from the campus norm.

Two companies that were part of a preexisting university center for innovation were the first to join. Breceda and Molina identified three additional companies, and in early 2006, the park opened with those tenants. Almost immediately, Sasken Communication Technologies, an Indian company, requested space for up to 100 engineers, and the university mobilized to improve accommodation and infrastructure.

The new Center of Innovation and Technology Transfer, dubbed CIT2, was off to a promising start, and the publicity generated by Sasken’s arrival drew other Indian firms to the project.

Getting down to work

With proof of concept in hand, Molina made a bold proposal. He had just become Tec’s vice president of research and technological development and was newly responsible for all Tec campuses, which numbered 24 at the time and would rapidly rise to 31. He felt strongly that Tec could promote economic development in the states where the university operated.

Molina developed an agreement with the federal government to create 21 technology parks on Tec campuses. Heriberto Félix Guerra, undersecretary of small and medium-size companies, signed the agreement; and Molina and Breceda plunged into the task of making the idea a reality. They built state-level support by inviting governors from relevant states to tour the flagship park in Monterrey.

Creating models

Molina realized that one approach would not work everywhere. Therefore, he and Breceda outlined three models that other campuses could consider. One model simply provided space near a campus, where high-tech companies could locate. The proximity to the university would lower the costs of hiring students, who would gain work experience and job opportunities. The companies might learn from researchers on the campus. “It was good for our engineering schools, good for our information technology schools,” Molina said. The second model helped people with ideas—including students—build new companies or enabled companies to improve and expand in ways that would enhance their revenues and increase jobs. The third model added research collaboration to the functions offered.²⁰

Each campus could identify the model and the kind of substantive specialization that would best match local economic strengths, campus research and teaching capacities, and market opportunities.

Tec de Monterrey agreed to cover the costs of initial operations on each campus, and the flagship campus negotiated support from the state and federal governments to share facility construction costs. Campus tech park directors, once chosen, would be responsible for creating operational budgets, for developing long-term financing strategies, and for applying for government research grants and funds for small and medium-size enterprises. Breceda's office had to supply advice on a continuing basis because creating medium-term revenue models was not easy. "To create the financial models for the parks was a challenge," Molina said.

To qualify as a tenant of a Tec technology park, a company had to be able to link students, researchers, and corporate activities. If a company just wanted to rent space, the park director had to refer the company's managers to other business parks nearby. This rule helped to keep the program true to its aims.

Planning and preparing

Molina and Breceda conducted a series of market analyses (1) to identify each state's economic capacities and relative competitiveness in several sectors and (2) to highlight clusters of activities that could strengthen each other. "So, really, you build around the competence of the region," Molina said. "Everybody wants to do IT, but it doesn't make any sense. Instead ask, 'IT applied to do what?' If you have the automotive industry, then you develop IT applied to the automotive industry." They also identified some of the support services, such as hotels, that would be necessary to attract and retain new business.

The Ciudad de México campus technology park exemplified the kind of focus needed. The director decided to concentrate on life sciences because in 2006 the campus was in the middle of the largest biomedical cluster in Latin America. Within a five-kilometer radius were 11 of the country's 13 national institutes of health and the

facilities of 15 of the 20 largest pharmaceutical companies in the world. Students at the park could help conduct or replicate preclinical trials and develop technology. "You have to very clearly understand the innovation process of your technology or your industry," said Beristain.

Each participating campus appointed three people to manage the project. These new managers participated in a training program Molina and Breceda had developed. The program shared advice about models and strategies and highlighted the best park experiences.

Providing landing services was an important first step in attracting the participation of companies. Such services included help in looking for homes and schools for workers, assistance in recruiting management, and help in installing technology.

The parks also had to offer around-the-clock support for the facilities. Even when the buildings were at the edges of the campus, as they usually were, the university had to provide electric power, for example. Campuses were accustomed to limiting electricity and other services during holidays or peak periods of use. For the companies, such disruptions were potentially damaging, and the university had to adjust its policies.

The three-person management team also built relationships between companies and local governments, and it worked with the university to recruit students and researchers. Breceda said Tec's network of trusted business consultants, lawyers, and other professionals played an important role in attracting tenants.

Negotiating

Attracting firms and negotiating collaborative arrangements also presented challenges. For example, big companies sometimes would sometimes seek special deals. No matter how attractive an investment a big company would bring, Breceda urged park

managers to adhere to the same terms for all tenants. To lure and retain smaller, vibrant start-ups, it was important to avoid giving concessions to larger companies that had deep pockets.

All agreements between Tec and the companies included a clause binding the company to collaboration. Without that clause, the parks would risk attracting companies that sought services and rental space but did little to develop new products and train or hire students.

Although Tec provided facilities and access to professional networks, researchers, and students, each tenant agreed to a contract that stipulated prices for water, electricity, security, and other services. Each also had to purchase a telephone landline to help it establish a legal address.

Maintaining the parks at about 85% capacity proved possible in most instances—and was about what most of the park managers could reasonably handle, Breceda said.

Collaboration

“Once you have the building, you have to make it alive,” Molina said. To succeed, each park would have to have a strategy for matching companies with the interests and capacities of professors, researchers, and students. “There has to be a living environment to really sustain a technology park. It is not like you’re renting an office,” he said. It took time and strong leadership to meet that goal. Molina’s team created opportunities for park managers to visit each other and learn from one another’s experiences.

One way to create an effective partnership in, for example, the IT field was to use a tenant’s software as a vehicle for instruction in a university class. Students would learn general concepts while also becoming familiar with the company’s product or system. For the company, that approach lowered training costs. Companies could simply hire students who had performed well, and they would be assured that the students already

knew how the software operated. In turn, the students appreciated that the skills they had learned in class would be useful in their careers, and they invested themselves more heavily, which also improved faculty morale. Molina said, “Everybody wins.”

Molina wanted all students to participate in this kind of interaction at least once before graduation. The program collaborated with companies to create summer opportunities for students to intern, apprentice, or take part-time jobs.

To make the approach work required some other steps as well. For instance, park managers learned they had to invite the companies to give conferences and play active roles in helping connect the professors with the students and the companies. Gradually, some of the park directors took other steps to facilitate collaboration among businesses. They sponsored social events and networking sessions at which people talked about recent failures. If one company hosted a conference, the other tenants received invitations. The university also joined the International Association of Science Parks and Areas of Innovation and started to participate in the association’s events, borrowing ideas about ways to foster collaboration from other countries.

To ensure that the parks truly inspired innovation and acted as incubators or accelerators for new enterprises, Tec de Monterrey initially limited the tenancy agreements to four years. Molina said, “We want them to move—establish, grow, and then move out.” That policy was consistent with the ambitions of the government’s program for small and medium-size enterprises as well as with the Tec’s philosophy.

Later, the university eliminated the four-year limit, though all leases remained short-term in order to avoid problems with evictions or contract violations. It experimented with awarding points to tenants when they hired students as employees, allowed students to do projects, provided

professional practicums, or participated in classes. Those that failed to accumulate a specified minimum number of points at year-end were asked to leave. Some of the companies that fell behind would race to accumulate points in the month before the annual evaluation, and increasingly, the program leaders found that as well as the total points, they had to look at the pattern of activity throughout the year.

OBSTACLES

Because of its size, the initiative required considerable coordination by the dean’s office. When Molina became head of the Monterrey campus, he lacked the time to follow up, and his bold plan for technology parks on every campus lapsed. The parks initiative required more supervision. On some campuses, talented leaders made up for the deficit, however, keeping the vision alive.

Breceda, too, learned that timing mattered in ways that hadn’t been obvious at first. Government funding cycles created several challenges. For example, construction projects and other activities often continued for more than one year and one budget cycle, but government accounting required that all objectives be met within the fiscal year the money was appropriated. The leadership team had to develop workarounds.

Further, grants often did not materialize on time, and Tec had to devise a system for smoothing the revenue or funding for park partners. Breceda guided park tenants through funding applications to minimize interruptions, and Molina persuaded the university to provide temporary funds for applicants that the applicants would repay when government grants were released.

A second kind of timing problem sometimes arose in connection with the university’s course schedule. When a project couldn’t be completed within a term, it was hard to evaluate student performance or manage student participation.

Park directors worked with companies to align their projects to fit the academic calendar.

RESULTS

At Molina’s direction, the university kept track of basic information about each park’s performance. As a result, it could monitor and compare investments, projects, and performance. According to Ibarra, the university began to evaluate the success of the parks according to four metrics: the percentage of tenants that met the academic linkage requirements (90% had to do so), external accreditations as business incubators or accelerators with the Ministry of the Economy, number of companies started by recent graduates, and financial capacity to be self-sustaining.

By the end of 2013, of the technology parks Tec de Monterrey was able to launch, 5 were working very well in the view of administrators, 6 had mixed records of success, and 3 were failing. In 2014, 13 parks remained. The 152 resident businesses had created 2,000 jobs, according to Beristain—about a quarter of them at the Ciudad de México campus. Tec had spent roughly 300

Figure 2
Incubators, Accelerators,
and Technology Parks

<i>Type</i>	<i>Number</i>
Intermediate technology incubators	25
High-technology incubators	8
Business accelerators	16
Virtual incubators	1
National network of technology parks	12
Number of jobs in parks	4,870
Indirect jobs from parks	14,610
Number of companies landed	1,365

million pesos (US\$22 million), according to Joaquín Guerra, a professor and former campus president. Although the university had had to invest more than it initially anticipated (roughly 50 to 60% of the actual cost), this expenditure helped make the concept a reality, Guerra stressed. “If we had seen this project as one about earning money, it wouldn’t have worked,” he said.

The five successful parks attracted companies and generated jobs for Tec graduates and students. The initiative also changed teaching at Tec: curriculum developers focused on industry needs and the practical application of knowledge rather than on pure theory.

The first years of Tec’s experiment generated several lessons: The parks had no shared operations manual because each tenant was supposed to tailor its activities to the local economy. Nonetheless, had a manual and a compilation of standard practices existed, some of the parks would have performed better—in Molina’s view. A more gradual rollout might have eased the problem because each new park could have learned from the others.

Those who participated in the parks project agreed that strong and effective leadership was a key element in the project. Guerra said, “The most important factors are the commitment and engagement of the people involved: the board of trustees, campus administrators, professors, private sector authorities, and students.”

The mix of tenants also influenced levels of success, as did proximity to certain kinds of businesses or services at a park’s edges. Getting

the right focus was important too, but identifying clusters of related enterprises that could link to existing supply chains proved a challenge for park managers at many campuses. Beristain said, “The parks that haven’t worked didn’t have clear business models.” Expanded analytic support for this function would have increased the probability of success. It also helped to have one large anchor business—and to have banks nearby, as was the case in Querétaro, one of the most successful parks.

Third, the model would not work at all universities, Molina concluded. At some, it was highly successful. One of the university’s technology parks grew to occupy a nine-floor building, with 120 companies in its incubator program (many more than it could house physically), an information technology cluster, and two floors devoted to graduate study and continuing education.

Guerra underscored the observation that it takes time for technology parks to realize their potential. “You have to build confidence,” he said. Companies had to see to be convinced, but as they saw the parks growing, they wanted to be part of them. It also took time to convince faculty members to move away from traditional ways of working and to think about how their research could help create a business.

Nonetheless, the Tec experiment was timely and had promise. In Molina’s view, it was important to “send a message to the community that we were doing something” to help, and technology parks were the best vehicles.

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