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The Baja California and Nuevo León Industry, Innovation, and Talent Clusters

Growing the California-Mexico Binational Economy

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Mexico Clean Economy 2050 (MCE2050) was founded as a Global Development Alliance (GDA) led by Stanford University with the support of the United States Agency for International Development (USAID) and contributions from private sector partners, universities, and research institutes, as well as non-governmental and civil society organizations. Originally spanning the period 2017–2020, MCE2050 was developed to inform the national policy design and implementation process in Mexico in order to promote clean innovation and low-carbon development in the United States-Mexico binational economy. From the start, MCE2050 focused on fostering increased connectivity and collaboration between California and two emerging innovation hubs in Mexico: (1) our neighbors, the state of Baja California and the cities of Tijuana, Mexicali, and Ensenada on the Mexican side of the binational region known as Cali-Baja, and (2) the state of Nuevo León’s capital city, Monterrey, a major regional industrial manufacturing center. Stanford continues to develop and expand this program with the support of the Precourt Institute for Energy, the Bill Lane Center for the American West, and other research centers and initiatives within the university. In the future, MCE2050 will continue to bring this knowledge base, research capacity, and the insights of the broader Silicon Valley innovation ecosystem to Mexico, while serving as a neutral convener to advance innovative technological, business, policy, and social solutions to regional and binational energy and environmental problems. This report on the innovation environments in Baja California and Monterrey, prepared by the Bay Area Council Economic Institute, contributes to that process.

Blas L. Pérez Henríquez

Director

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Like other countries, Mexico's states and cities define its economic landscape. Of those, several regions cluster industry and talent in ways that particularly connect the Bay Area and California. This report examines two: Monterrey in the state of Nuevo León and the Tijuana-Mexicali-Ensenada complex in the state of Baja California Norte. Each presents a unique environment and distinctive assets that are attracting—or could attract—California and Bay Area investment and research partnerships.





Baja California

Business and Industry

Bordering California's San Diego and Imperial counties, northern Baja California is usually thought of as a tourist destination and a site for the cross-border manufacturing facilities known as maquiladoras. Like those of a number of other Mexican states, however, Baja California's environment is changing based on a new commitment to research, higher education, and entrepreneurship. As the state's economy is still heavily based on manufacturing, that transformation is still a work in progress. What makes Baja California Norte unique is the investment focused on the cities of Tijuana, Ensenada, and Mexicali, that is capitalizing on the region's proximity to San Diego and California. This is contributing to the development of a dynamic cross-border economy in what is becoming known as the Cali-Baja region.

The San Ysidro Land Port of Entry is the busiest land border crossing in the Western Hemisphere,¹ with an average of more than 100,000 bus passengers, pedestrians, and personal vehicle passengers making the northbound crossing of the Tijuana-San Diego border there each day. In 2019, there were more than 36.6 million northbound crossings of vehicle passengers and pedestrians at San Ysidro (which doesn't allow freight crossings) plus 1.7 million northbound truck and full truck container crossings 6 miles away at the Otay Mesa port of entry² (reflecting the region's cross-border production). In addition, both types of 2019 northbound truck crossings at the two other California-Mexico freight crossings totaled 105,000 for Tecate (the third

San Diego area port of entry) and 647,000 for the Calexico East crossing from Mexicali.³

With a population of more than 2 million and one of the fastest growth rates in the country,⁴ Tijuana is the largest city in the state of Baja California and the fifth largest in Mexico, and it concentrates the region's research and production activity. Other key cities include the state capital Mexicali (with a population of more than 1 million) and the port city of Ensenada (with a population of 335 thousand).⁵

The region is an important production base for industries including aerospace, medical devices, biotechnology, automobiles, and electronic equipment. Other key sectors include agro-industry, particularly wine. Most companies concentrate in 101 industrial parks close to the border,⁶ including 65 in Tijuana⁷ and more than 25 in Mexicali,⁸ where activity is led by manufacturing.

- The *medical devices* sector benefits from proximity to industry clusters in Southern California. More than 70 medical technology companies are engaged in design, assembly, manufacture, sterilization, and other processes, with a workforce of 61,000.
- Aerospace activity focuses on components, with more than 94 companies supporting over 35,000 employees, comprising the largest concentration of aerospace companies in Mexico (at 21%) and more

than half of Mexico's aerospace workforce. Over half of the aerospace companies in Tijuana have more than 500 employees, in fields ranging from commercial aviation to defense, space (satellites), and drones. Beyond assembly and subsystems manufacturing, processes include design, R&D, and the development of advanced materials, with production for companies such as Boeing and Airbus.

- *Biotech* activity is concentrated in Ensenada and in 37 research laboratories across the state.
- The *automotive* sector is anchored by two assembly plants operated by Kenworth (PACCAR Group), which produces heavy trucks for a worldwide market, and Toyota, which assembles the Tacoma truck. Altogether, 80 automotive companies operate in the region, including a wide range of parts suppliers.
- The *electronics* sector, long the region's anchor, comprises more than 200 companies producing products including circuit boards, flat screen televisions, cellular phones, home appliances, computers, and semiconductors, with a workforce of 92,000.⁹

Outside of manufacturing, medical tourism—offering advanced procedures in fields such as cancer treatment, dentistry, and ophthalmology—is growing rapidly. Feature film production is another sector with a well-established base and significant potential for growth. Wine production, centered in the Guadalupe Valley, aggregates more than 100 wineries¹⁰ and related restaurants, inns, and event spaces in Mexico's equivalent to Napa Valley. The state of Baja California ranks third in Mexico in the value of total international exports (US\$36 billion in 2017), accounting for 10.4% of national exports. Forty percent comes from manufacturing.¹¹ The region's production is overwhelmingly destined for US markets, followed by markets in Canada. The US is the source of 80.7% of foreign direct investment (FDI) in the state, followed by South Korea (3%), Japan (1.9%), Canada (1.9%), Spain (1.4%), and China (1.3%), with others accounting for 9.8%.¹²

The region's development as a global business center is rooted in the maquiladora program (formally known as Programa de la Industria Manufacturera, Maquiladora y de Servicios de Exportación or IMMEX), which enables contract manufacturers in Mexico to defer taxes on

imported components, raw materials, and manufacturing equipment, and to pay lower taxes on finished products exported to the US. According to CANACINTRA (Cámara Nacional de la Industria de Transformación or National Council for Industry Transformation), 98% of inputs for Tijuana's maquiladoras are imported.¹³ One of CANACINTRA's goals is to increase purchasing by maquiladoras from local suppliers, to support small businesses and entrepreneurs. To further that objective, in 2018 the state government passed the Ley de Fomento a la Proveduría Local (Law for the Promotion of Local Suppliers), which provides fiscal incentives to maquiladoras to increase their purchasing from local suppliers and creates a fund to support local SMEs through trade fairs, trainings, and certifications.¹⁴

Some of the earliest international companies came to Tijuana and Mexicali from Japan, with most clustered in the electronics sector. In the early 2000s, Tijuana was the world's top site for the production of television sets, led by companies such as Sony. As the industry and technology changed, Japan's presence receded and South Korea's grew, joined later by companies from Canada, China, and Europe.

While still anchored in assembly, production has been moving to higher levels of value-added content and more complex products. In recent years, that shift has included a focus on integrated solutions that include software and R&D.

In the automotive sector, prior to the 2010 closing of Toyota's joint venture in Fremont with General Motors—New United Motor Manufacturing Inc. (NUMMI)—there had been close collaboration with Toyota's facility in Tijuana. With NUMMI's demise, parts of Toyota's Fremont activity moved south. Training today is continuous, with Mexican engineers regularly traveling to Japan and Japanese engineers traveling to Tijuana. Work performed there includes the development of automated equipment and applications software, both for global markets.

Though still small, service trade is also growing based on computer systems design, scientific R&D, software publishing, data processing, and other professional, scientific, and technical services.¹⁵ For example, US-based global biotechnology company Thermo Fisher Scientific has more than 200 software developers working at its IT Center of Excellence in Tijuana.¹⁶

SPOTLIGHT

Honeywell

Honeywell International, a Fortune 500 company producing commercial and consumer products, engineering services solutions, and aerospace systems, has had a manufacturing presence in Baja California since 1979, and today employs more than 2,000 people at its Mexicali sites. Since 2007, it has supported a center for engineering and design that employs 350 Mexican engineers. In 2017, the company added a wind tunnel, an investment of 300 million pesos, to permit the testing of aircraft turbines for companies including Boeing, Airbus, and

Embraer. According to Luis Sanchez, the president of Honeywell Mexico, "Mexicali offers a wide range of advantages for a company like ours, including access to a motivated and able labor force and strong educational infrastructure that includes many highly-qualified universities."*

* Content supplied by Mark Rinder, Fulbright Grantee & Intelligence Analyst, Endeavor Mexico; <https://mexico-now.com/honeywell-aerospace-to-invest-us-15-million-in-mexicali/>; <https://manufactura.mx/industria/2018/02/02/honeywell-presume-su-planta-de-aeronautica-en-mexicali>.

SPOTLIGHT

Film and Animation

In the last two decades, Baja California has developed a substantial base for film production centered on Baja Studios, a facility located on the coast south of Tijuana and Rosarito Beach. Originally built by Twentieth Century Fox for the filming of *Titanic* in 1997, the campus houses the world's largest water tanks and stages designed for filming. Subsequent productions have included MGM's *Tomorrow Never Dies*, Warner Brothers' *Deep Blue Sea*, Disney's *Pearl Harbor*, and Fox's *Master and Commander: The Far Side of the World*. More recent production has focused on television series such as *Fear the Walking Dead* and streaming films for Amazon, HBO, and Netflix. Those high-end productions have enabled an accumulation of localized experience and expertise. Lower costs, more flexible unions, proximity to Hollywood, and access to a complete pipeline of services from pre- to post-production are also enabling growth in the sector. *Fear the Walking Dead*, for example, required advanced visual effects. Where visual effects artists were once brought in from Santa Monica and Canada, today most work in the field is local.

Feature film production has generated a supporting ecosystem of digital content studios such as iDigital Groups, which has both advertising and film divisions. Starting with production services, the company is now generating its own IP, with a new film in post-production, and supports a post-production and animation unit focusing on virtual reality and

augmented reality. iDigital founder Gabriel Reyes, a systems engineer, wants to improve the efficiency of filmmaking by applying industrial engineering methods. As he explains, "There's nothing in film production like ISO 9000, Six Sigma, or other certifications that ensure efficiency and quality in the production process. The industry should be more efficient in how it works, which the engineering discipline can address." The company is currently working with partners at Stanford and World Building, a Cali-Baja innovation collective organized by Pigeon Hole Productions from San Diego, to establish XR Cinema Lab, a software-based "extended reality" center that builds on the experience of digital designers in world building for films and will be housed at Baja Studios, to test out new ideas applicable to social and economic issues as well as entertainment.

Other Baja California companies in the industry include Boxel Studio, a ten-year-old visual content studio employing 40 artists and technicians. Focusing on visual effects (VFX) and animation, Boxel works with US companies such as the History Channel, Nickelodeon, Hulu, and Netflix (*Medal of Honor* docudrama). The pipeline of designers and technicians is supported by degree programs in animation and filmmaking at local universities.*

* <http://www.bajafilmstudios.com/>; Interview with Gabriel Reyes, April 2020; <http://boxelstudio.com/>.



Postgraduate Building, CETYS Tijuana campus

University and Research Environment

Much of this activity builds on a growing base of trained engineers that supports an active developer community; of the more than 2,500 students graduating each year from Tijuana's more than 35 universities, about 27% are engineers.¹⁷ In addition to hardware and software engineering, other fields of study include computer systems, multimedia design, digital graphic design, and animation and visual effects. Tijuana is also home to 186 technical and high schools that offer accredited programs in engineering, sciences, IT, business, and many other areas.¹⁸ Regional universities are working to develop new degrees and programs to provide the technical skills that companies require.

Key universities and research institutes include the following:

- Established in 1551, today **UNAM** (Universidad Nacional Autónoma de México or National

Autonomous University of Mexico) is a public research university.¹⁹ Headquartered in Mexico City, UNAM has satellite campuses in almost every Mexican state as well as in the US, Canada, and Spain.²⁰ UNAM's Baja California campus in Ensenada is home to the Centro de Nanociencias y Nanotecnología (see below).

- **UABC** (Universidad Autónoma de Baja California or Autonomous University of Baja California), the fifth largest public university in Mexico, had over 68,000 undergraduate and 3,500 graduate students in 2019 spread across its three main campuses: Mexicali, Tijuana, and Ensenada. Priorities address key sectors of the state's economy including agriculture, fisheries, tourism, commerce, and industry, and support active partnerships with the business community.²¹ Included in the university's 134 undergraduate and 64 graduate programs are 15 in engineering (including computer

systems, bioengineering, aerospace, civil engineering, electronics, renewable energy, robotics, mechanical engineering, nanotechnology, and chemistry). During 2019, there were 8 research institutes and 670 funded research and technology development projects.²² International agreements are in place with 140 universities,²³ and joint degrees are also offered with universities in Spain, Chile, and Colombia, as well as two universities in California (UCSD and UCLA).²⁴ Other joint research, teaching and exchange programs are in place with San Diego State University, UC Irvine, and Scripps Institution of Oceanography, as well as MIT and in projects funded by NASA, the National Science Foundation (NSF), and UNESCO.

One distinctive UABC program is its School of Enology and Gastronomy, which supports Baja's growing food and wine sector. Research on the properties of Baja California wines, consumer preferences, and soil and water technical analysis supports regional viticulture companies, while collaborations with wineries and restaurants deliver a professional practicum for students. In addition to collaboration agreements with the Universidad de la Rioja (University of Rioja) in Spain, the school recently signed a letter of intent to collaborate on enology research with California State University, Fresno.²⁵

- **CETYS Universidad** (Centro de Enseñanza Técnica y Superior or Center for Technical and Higher Education), a private university with 500 academic staff and approximately 7,700 students, has three campuses—in Tijuana, Mexicali, and Ensenada.²⁶ While its laboratory space is limited and most of its entrepreneurs are young, the school has a significant focus on innovation-based entrepreneurship, including a nationally accredited business incubator.²⁷

Research institutes are particularly growing in Ensenada, a city that until recently was better known for its port and tourism.

- **CICESE** (Centro de Investigación Científica y de Educación Superior de Ensenada or Center for Scientific Research and Higher Education in Ensenada) is the largest institution of the 27 that make up CONACYT (Consejo Nacional de Ciencia y Tecnología or National Council for Science and Technology). Currently it supports 530 research staff

and technicians, working on almost 400 research projects across Mexico. Its center in Ensenada supports 113 laboratories in four academic divisions: experimental and applied biology, earth sciences, applied physics, and oceanography. Leading fields include marine ecology, environmental geosciences, marine biotechnology, computer science, optics, geothermal energy, seismic engineering, and aquaculture. A number of research projects are being developed jointly with business and government counterparts; corporate partners from the United States include Chevron, Plantronics, Intel, and IBM. Products and applications from this research range from fish farming to antibodies derived from sharks, diagnostics for trichinosis, oil spill remediation, and nanosatellites developed for the Mexican army.

While for most of its 40 years CICESE has focused on academic research (and generated few patents), more recently it has shifted to more applied research—working to identify projects with commercial potential that can be pushed to market and in the process support students and post-graduates who could be entrepreneurs. Seven years ago, an Office of Technology Transfer was created, and research collaboration with industry expanded. Under an agreement with the National Science Foundation in the United States, the center uses the I-Corps entrepreneurial support method adopted by Bay Area universities such as Stanford and Berkeley to orient scientific researchers to entrepreneurial opportunities. University research partners in California include the Scripps Institution of Oceanography (San Diego), UC San Diego, UC Riverside, UC Irvine, and UC Davis.²⁸

- **CNyN** (Centro de Nanociencias y Nanotecnología or Center for Nanosciences and Nanotechnology) got its start in 1983 as UNAM's Ensenada physics laboratory (LEIF or Laboratorio de Ensenada del Instituto de Física).²⁹ Today, its specialists in nanomaterials, bionanotechnology, nanocatalysis, nanostructures, microelectronics, and nanofabrication focus on transforming technology in the areas of medicine, energy and the environment, and human activities.³⁰ Each year, CNyN graduates approximately 10 students with bachelor's degrees in nanotechnology, 10 with master's degrees, and 5 with doctorates in materials engineering and physical sciences. Industry research

partners include CIDETEQ (Centro de Investigación y Desarrollo Tecnológico en Electroquímica or Center for Research and Technological Development in Electrochemistry), Honeywell, and Pemex. Collaborations in bionanotechnology and physics are also underway with UC San Diego.³¹

- The **Centro de Estudios Vitivinícolas** (Center for Wine Studies), a degree-granting program at CETYS, provides research laboratories and training to support Baja California's burgeoning wine industry.³² The center is located close to the Guadalupe Valley, a fast-growing viticultural region that is home to more than 100 wineries.³³

Collaborative research between universities and with industry is encouraged by the national innovation research program (Programa de Estímulos a la Innovación or PEI) run by CONACYT. Analysis suggests that the program is finding success, most often with UABC at the center.³⁴

Technology and Innovation Environment

Overall, Baja California presents a mixed picture when it comes to science and innovation. Rankings in 2018 of the 32 Mexican federal entities (31 states plus the Ciudad de México federal district) by CAIINNO

(Centro de Análisis para la Investigación en Innovación or Analysis Center for Research in Innovation) show Baja California near the top in science (#8 in Public and Private Investment in Science, Technology and Innovation; #2 in Higher Education; #6 in Scientific Output; and #2 in Information Technology), but lagging at the private sector level (#32 in Innovative Companies and #28 in Entrepreneurship and Business.)³⁵ Startup activity in Baja California is still in the early stage, with risk capital—angel investment and public or private venture capital—very limited. Approximately 90% of the startup funding that does exist comes from outside Mexico, and startups that reach the growth stage usually raise capital in California.³⁶

A range of facilities and initiatives are being developed to accelerate the state's innovation ecosystem and support entrepreneurial growth:

- **COCITBC** (Consejo de Ciencia e Innovación Tecnológica de Baja California or Council of Science and Technological Innovation of Baja California), part of the state government's secretariat of economic development, is seeking to address these shortcomings through strategies designed to build a sustainable innovation system in the region.³⁷ Among other initiatives, it has developed a fund to which companies may apply for scientific research funding. To be eligible, projects must either be large (to advance growth) or address a significant problem in the community.



CICESE auditorium (center)

- The **BIT Center**, also developed with state government support and housed in a former supermarket in Tijuana's city center, is the city's major incubator facility. It provides co-working space, small private offices, and conference and training rooms for use by entrepreneurs, schools, and universities, and also offers free areas for use by freelancers.³⁸
- The **Consejo de Desarrollo de Tijuana** (CDT or Tijuana Development Board) is a key private initiative supporting entrepreneurship programs.³⁹
- **MIND Hub** (Mexico Innovation and Development Hub), co-founded in 2011 by Ángel Sánchez and Jorge Arroyo of Arkus, Inc., is a collaborative tech innovation space in the heart of Tijuana's financial district. With a focus on enabling technology on either side of the US/Mexico border, it houses tech and related services companies. Current campus occupants include the software consultancy Arkus Nexus and several graduates of MIND Hub's incubation program, and the space also hosts local US and Mexico tech communities such as StartupSD. Its incubation/acceleration program is no longer operating, however, and has stopped accepting startups.⁴⁰
- **BlueBox**, a Latin American accelerator offering training for entrepreneurs, innovation workshops, office space, and an incubation program, operates one of its three Mexican programs in Tijuana.⁴¹
- The accelerator program **Endeavor** had a presence in Tijuana from 2008 to 2019, when it consolidated its Mexican operations in Mexico City, with active staff in other domestic markets. While the reorganization allowed Endeavor to focus on regions with higher flows of entrepreneurs, it continues to maintain a network of local contacts and mentors and holds local events. A Baja California "community leader" is based in Mexico City.⁴²
- Positioning CETYS Universidad to better connect with private sector companies doing aerospace R&D in Mexicali, **CEID** (Centro en Innovación y Diseño or Center for Innovation and Design) opened in 2018 on the CETYS campus in Mexicali. CEID aims to sponsor ten innovation projects each year, taking the space industry in Mexicali to the next level.⁴³

The region's large industrial base is starting to become a significant source of tech company founders—typically engineers who at one time worked at large companies such as Sony, in some cases went to work at large or small consulting firms, and eventually started their own

companies. One noteworthy entrepreneur is CETYS Universidad graduate Jordi Muñoz who, after moving to San Diego, co-founded 3D Robotics in 2009.⁴⁴ Until it shifted away from manufacturing and consumer markets to focus on enterprise software, 3D Robotics was the largest producer of consumer drones in the US. The company attracted close to \$100 million in venture funding, manufactured in Tijuana, and was led from offices in Berkeley and Mexico, with additional presences in San Diego and Austin.⁴⁵

Opportunities and Issues

What uniquely distinguishes Baja California from other Mexican regions is its physical proximity to California, which offers advantages in time, access, and operational efficiency. Beyond manufacturing, the Cali-Baja border region presents a range of opportunities for both Mexican and California companies.

One is the opportunity to increase the production and use of renewable energy (particularly wind and solar), where capacity is underdeveloped but demand is growing on both sides of the US border. Mexico's Secretaría de Energía (Ministry of Energy) predicts that Baja California will need an additional 67,000 MW of electrical power by 2032.⁴⁶ Despite the region's abundant land and sun (Baja California has some of the highest levels of solar radiation in Mexico) however, only 21% of total power generation in Baja California is currently produced from renewable sources, including geothermal.⁴⁷ IEnova, a subsidiary of San Diego-based Sempra Energy with a presence in 17 Mexican states, operates the Sierra Juárez wind farm close to Mexicali, with 47 turbines and long-term plans for up to seven times more. Since production began in 2015, 100% of its production is sent to the United States, helping California meet its renewable energy goals.⁴⁸ IEnova also operates the 41 MW Rumorosa solar facility close to Mexicali.⁴⁹ Transmission lines in two main border-crossing areas are managed by the Western Electricity Coordinating Council (WECC),⁵⁰ Mexico's CFE (Comisión Federal de Electricidad or Federal Electricity Commission), and the California Independent Systems Operator (CAISO). These facilities suggest a model for how renewable energy can grow to support more production inside Mexico and stronger connections between the California and Baja California grids.⁵¹

SPOTLIGHT

El Florido

El Florido, a large development in southeast Tijuana, is an example of the new business and production model that Tijuana is endeavoring to embrace. Within its scope is Los Nogales, a master-planned, mixed-use community that includes future housing and commercial, hotel, residential, healthcare, sports, cultural, educational, and research facilities, such as ITT (Instituto Tecnológico de Tijuana or Tijuana Institute of Technology), as well as open space. Also present in Los Nogales is the Consorcio Tecnológico de CONACYT, which houses not only SEPROA (the newly created Secretaría para el Manejo, Saneamiento y Protección al Agua or Secretariat for the Management, Sanitation and Protection of Water) but also SEST (the Secretaría de Economía Sustentable y Turismo or Secretariat of Sustainable Economy and Tourism), as sustainable water, economic, and tourism issues are all seen as decisive for the future and growth of Baja California.

Also within El Florido, the new Los Olivos Logistics and Industrial Park includes 2,372,000 square feet of production space, joining an existing industrial park, La Encantada, with a diverse base of tenants. La Encantada Industrial Park, the heart of El Florido, with 2.3 million square feet of built-out space, is home to 16 companies producing electronic parts, aerospace components, and a range of healthcare and industrial products. Growing interest is being reported by companies from Korea and elsewhere in Asia, as well as US-based companies, in opening new industrial

facilities. Cecilia Romero Larroque, Asset Manager with the El Florido Group, believes “their goal is to be closer to the US market, not offshore in Asia.”

Higher education facilities located in El Florido include UTT (Universidad Tecnológica de Tijuana or Tijuana Technological University), a public university with 5,000 students that offers technical and engineering degrees; ITT, a public university currently building a 3,000-student campus that will offer majors in engineering as well as masters and doctorate degrees; UNEA (Universidad de Estudios Avanzados or University of Advanced Studies), a private university with 800 students that offers majors that include systems engineering, industrial engineering, business administration, and international trade; and CECyTE Baja California (Colegio de Estudios Científicos y Tecnológicos del Estado de Baja California or College of Scientific and Technological Studies of the State of Baja California), a technical college that trains approximately 2,300 students. With proximity between industrial facilities and educational institutions, strengthening the links between research, workforce development, and production is a key focus.

Sources: Information provided by Cecilia Larroque, Asset Manager, El Florido, March 2020; “El Florido – A Master Planned Community,” <http://florido.com/>; and Dias, Tito, “El agua es determinante para el futuro y crecimiento de Baja California,” *Dario Tijuana*, May 29, 2020, <https://diariotijuana.info/el-agua-es-determinante-para-el-futuro-y-crecimiento-de-baja-california/>.

On the production side, the Bay Area's Sun Power has manufactured and assembled solar panels in Mexicali since 2011, and in 2019 donated 10% of the 3,000 panels going into two new solar arrays being built on the Mexicali and Tijuana campus of CETYS University. At 1.2 MW, the project represents the largest renewable energy initiative in Mexico to be built by a university and builds on CETYS's well-established renewable energy engineering track.⁵² A third promising area for cooperation is clean energy research and policy collaboration with the state of California, which leads the United States in the field of renewal energy research and in policies to enable both energy efficiency and clean energy adoption. The Mexico Clean Economy 2050 project, a global development alliance launched by Stanford University's California Global Energy, Water and Infrastructure Innovation Initiative with support from the US Agency for International Development (USAID), is actively exploring opportunities to expand the production and use of renewable energy in Baja California and greater energy cooperation in the Cali-Baja region.

The State of California will play an expanded role through an MOU currently being negotiated between the California Energy Commission (CEC) and its counterpart in Baja California to cooperate in a range of fields relating to the shared grid, including building efficiency (shared codes and standards), industrial efficiency (of value to the maquiladoras), and renewable energy production that can both help California meet its targets for the production of renewable energy and address reliability issues in Baja California. The MOU and the activity it generates will be one of the deliverables of the revived Commission on the Californias (see below).⁵³

In the innovation space, the presence of industrial clusters hosting large US and international companies presents an opportunity for Mexico's government and universities to work more closely with entrepreneurs to produce technologies and services that can help manufacturers advance to higher value-added production. The region's established industrial base and infrastructure also present both location sites and market opportunities for US technology companies. The extension of NAFTA through the recently approved US-Mexico-Canada Trade Agreement

(USMCA) also allows Baja California to benefit from repositioning by US companies looking to reduce political vulnerability and shorten supply chains by returning production to North America. With no time zone difference with California, and Tijuana being as little as two hours away from the Bay Area (by air to San Diego and car across the border), proximity affords Baja California a unique advantage as a site for near-shore business location.

Underlying its potential for more advanced production and research, Baja California's universities are generating a large number of engineers who possess the skills required by both large and small companies and can be hired at a fragment of the cost of comparable engineers in Southern California or Silicon Valley. A pool of creative talent with industry experience also supports the film sector. Proximity to the border, a low cost of living, and a dynamic food, wine, and craft beer scene make Tijuana a potentially attractive site for Bay Area and other companies that are looking for engineering talent.

For Tijuana, leveraging this talent pool to support home-grown innovation and startup activity still presents challenges. Entrepreneurial activity in the region remains constrained, and there are no large, home-grown, private companies that can spin out new startups—though as mentioned earlier, engineers do leave maquiladoras to start their own companies. MIND Hub shuttered its startup incubation activity primarily due a shortage of investment capital. Most venture funds focus on Mexico City, and companies that successfully raise funds often do so in California, operating as California entities. A related challenge is that until now the region has not produced breakthrough companies at scale, a milestone that can serve to attract venture investors.

This points to the major challenge as Baja California attempts to build an innovation economy: the need to transition its manufacturing economy toward higher value-added activity through a deeper connection to R&D. Production processes have been perfected over the years, making the Tijuana-Mexicali region a highly efficient place to manufacture. The level of new

value creation, however, is low. To date, innovation has come primarily through efficiency gains that have progressively lowered costs, but most true R&D continues to be done in places like the Bay Area or Boston—or overseas. With so many large US and global companies established in the region, there is a significant opportunity for industrial innovation. In aerospace, for example, more products could be developed and designed locally, more deeply integrating local firms into the global aerospace supply chain. Solar panels are being manufactured in Tijuana but as a next step could incorporate more local design and engineering.

Large international companies are starting to play a greater role in R&D; for example, Samsung does so through its Tijuana software development center. Other companies, such as Honeywell, Plantronics, Thermo Fisher, Skyworks, Solar Turbines, and Japan's SMK, are starting to produce locally generated IP, with new design centers being established. Across multiple sectors, expansion of the local R&D base will be central to the Tijuana-Mexicali-Ensenada region's ability to achieve higher value-added production and more innovation-based growth.

Baja California's connection to California to the north also has a significant state-to-state dimension. Agency level relationships are in place between the two governments, such as the MOU signed in November 2019 with California's Office of Emergency Services (OES) to share information and cooperate on best practices and training. That agreement re-confirmed an earlier MOU and a cooperative relationship that was initiated in 2008.⁵⁴

In December 2019, California's Governor Gavin Newsom and the Governors of Baja California Norte and Baja California Sur signed an MOU re-establishing

the **Commission for the Californias**, a forum for sharing ideas around common issues and devising shared solutions.⁵⁵ Topics that have been identified for shared information and cooperation, and that involve multiple California agencies, include energy management and grid resilience, water resources and quality, transportation infrastructure, cross-border trade and investment, agriculture, public health (cross-border disease management, a particularly salient topic in the wake of the COVID-19 crisis), and emergency preparedness.⁵⁶ Moribund for many years, the revived Commission offers a systemic vehicle to better connect the neighboring economies of Mexico and California as a binational economic region.

The economy of northern Baja California has evolved dramatically from the days when Tijuana was largely a destination for day-tripping tourists from San Diego. High-rise towers now dot the landscape, a gastronomic district has developed with craft breweries and Mexican-Mediterranean fusion cuisine, the region hosts a growing pool of engineers, and R&D is starting to play a larger role. Tijuana now serves as a significant node on a West Coast IT chain of research, engineering, and production that extends from Guadalajara to Seattle. Economic synergy, cross-border university programs, and transportation links with San Diego and Southern California enable complementary activity that can bind the Cali-Baja region more deeply as a binational economy and support deeper ties with Northern California as well. Although the maquiladora system is well established and ties with Southern California are strong, Bay Area and Silicon Valley companies tend to look first to other places in Mexico such as Guadalajara and Mexico City to invest or to find talent. A more concerted strategy by Baja California to grow its innovation infrastructure could potentially influence that calculation.

Monterrey

Business and Industry

The state of Nuevo León enjoys the highest per capita GDP in Mexico (US\$16,107 in 2018, almost twice the national level of US\$9,341), leads other states by a significant margin in its attraction of foreign direct investment (drawing 13% of the nation's total in 2018), and accounts for more than 9% of Mexico's manufacturing exports. Reflecting the region's strong manufacturing base, the lion's share of FDI (64%) is drawn by manufacturing, followed by financial services (11%) and commerce (7%), with most FDI coming from the United States. Manufacturing worker productivity is the highest in Mexico. Nuevo León's 4.2% economic growth in 2018 also substantially exceeds the 2% national average.¹

A center of private business and home to a high percentage of Mexico's largest companies, the Monterrey metropolitan area is headquarters for leading corporations including CEMEX, Banorte, Banregio, FEMSA, Gamesa and OXXO. Large multinationals such as Boeing, Caterpillar, Dell, GE, Mercedes-Benz, Philips, and Siemens also have major presences there.²

Close to Texas and the US border, commerce builds on transportation infrastructure that includes direct air service to twelve US cities (including Los Angeles) and cargo transport through regional hubs of companies such as DHL, FedEx, UPS, and Estafeta. The Laredo-Colombia Solidarity International Bridge sees approximately 1,000 northbound truck crossings per day between the United States and Mexico.³ With this

proximity, business culture more closely resembles that of the United States than other states in Mexico.

Since 2007, the city has supported an initiative, Monterrey: International City of Knowledge, that works to attract R&D talent to Monterrey as well as investment in infrastructure. This has led to the establishment under the government's science and technology agency I2T2 (Instituto de Innovación y Transferencia de Tecnología or Institute of Innovation and Technology Transfer) of PIIT (Parque de Investigación y Innovación Tecnológica or Technology Research and Innovation Park), which has attracted both institutions and private businesses. Universities and national research organizations have a presence, while companies with labs or product design activity include CEMEX, Schneider Electric, and Pepsico. The park also hosts two incubators—for nanotechnology and biotechnology.

More recently, Monterrey's strategic focus on R&D and innovation is being built on a government initiative, **Nuevo León 4.0**, with a major focus on digital transformation. Launched in 2017, it focuses on new technologies and business processes such as IoT, machine-to-machine communication, AI, digital manufacturing, big data, 3D printing, and advanced design, with the goal of helping Nuevo León's industrial sector compete globally through the development of smart factories. Developing high value-added labor skills is a related focus. Though led by the government,

the board is made up of the state's four leading universities, the state secretaries of education and economy, the head of CONACYT (Consejo Nacional de Ciencia y Tecnología or National Council for Science and Technology), and the head of CAINTRA (Camara de la Industria de Transformacion de Nuevo León or Transformation Industry Chamber of Nuevo León), with implementation in the hands of private industry. Its chair is reserved for the CEO of an industrial firm rather than a state official. Task forces help coordinate activity between manufacturing heavyweights in key sectors such as steel, building materials, automobiles, aircraft, electricity, food, and infrastructure.⁴

University and Research Environment

Corporate investment draws on a pipeline of human capital provided by leading universities including **UANL** (Universidad Autónoma de Nuevo León or Autonomous University of Nuevo León), **UDEM** (Universidad de Monterrey), **UMM** (Universidad Metropolitana de Monterrey or Monterrey Metropolitan University), and the

private **Tecnológico de Monterrey**, Mexico's equivalent to MIT. Residents of Nuevo León pursue higher education at a higher rate than elsewhere in Mexico; although Nuevo León is the 8th most populous state in Mexico,⁵ it has the 4th highest number of undergraduate university students and the 5th highest number of graduate students.⁶ In 2019, 193,000 students were enrolled in undergraduate and graduate programs, of which 82,000 were in science, technology, and engineering fields. Twenty-six thousand were at the graduate level, of which nearly 13,000 were in science and engineering programs. Six thousand were at the post-graduate level, of which 2,000 were in science and engineering.⁷

This educational infrastructure serves as a critical base for company formation. Each year on average, Nuevo León's universities and technical schools graduate more than 11,000 technicians and 7,500 engineers, grant more than 1,000 master's degrees and PhDs, and participate in the Nuevo León 4.0 strategy to empower the state's industry 4.0 ecosystem, which is the first initiative of its kind in Mexico.⁸ Tecnológico de Monterrey and UANL host particularly strong computer science programs.



UDEM Main Administration Building (Rectoria)



Tec de Monterrey Rector's Office and Advanced Technology Center

Tecnológico de Monterrey

Tecnológico de Monterrey plays a central role in fostering innovation and entrepreneurial development in the city and the state, as well as nationally. A private institution, the university was founded in 1943 by business leaders concerned with the shortage of engineers and middle managers needed to support Mexico's incipient industrial expansion. In 1950, it was the first foreign institution in the world to receive accreditation from a US body. In the 1990s, it was the first university in Latin America to connect to the internet and was also among the first in the hemisphere to create a virtual university. By 2000, Tec de Monterrey had grown to 26 campuses in 20 Mexican states, that today serve more than 93,000 high school, undergraduate, and graduate students.

Approximately 88% of Tec's Board of Trustees (450 out of 510) are business leaders, and 41% of its alumni have gone on to start businesses, generating economic value equivalent to 19% of Mexico's annual GDP. Reflecting this, The Princeton Review and *Entrepreneur* magazine

rank Tec de Monterrey #8 in the Top Schools for Entrepreneurship Studies 2020 survey, making it the only university outside the United States to be listed. Tec de Monterrey graduates account for 27% of Mexico's top 100 CEOs.

Through Tec de Monterrey's Institute for Entrepreneurship Eugenio Garza Lagüera, students are exposed to and trained in entrepreneurial processes. Students from all disciplines are required to create a company at some point in their academic career, with more than 10,000 participating in an entrepreneurial challenge in their first semester; not every company is legally incorporated, but everyone participates in a project that generates revenues.

Beyond its academic programs, Tec de Monterrey offers innovation hubs and incubators throughout the country, supporting more than 800 projects each year; in the last 14 years, the incubator network has graduated more than 4,000 companies. Approximately 20% of alumni establish a company or go to work at a new company within three months of graduation. An independent

survey of alumni by university ranking firm QS suggests that 41% have started for-profit businesses (compared to 15% for universities as a whole in Mexico and 25% at MIT), of which 65% are still in operation. Entrepreneur-related partnerships and alliances are in place with leading universities in the United States and around the world, including Stanford and UC Berkeley in California.⁹

A 2018 Endeavor Insight survey of 153 founders of entrepreneurial companies in the Monterrey tech sector found that the primary undergraduate major of those founders was engineering (46%), followed by business and computer science (13% each). The majority had obtained their undergraduate degrees from local universities, and more than half studied at Tecnológico de Monterrey. Less than half of the interviewed founders obtained graduate degrees; of those, 55% obtained MBAs.¹⁰

Reflecting the strength of Tec de Monterrey's engineering and computer science programs, technology companies from the United States regularly come to recruit talent through "Microsoft Week," "Google Week," and other outreach programs. Approximately 70% of those hired eventually work in the United States—in San Francisco, Seattle, and other technology centers. In addition to a continuous calendar of entrepreneur-focused programs, each year since 2013 the university has hosted INCmty. Modeled on Austin's South by Southwest, INCmty is the largest entrepreneurial festival in Latin America. In 2019, more than 10,000 participants gathered across more than 400 events.

Partners, supporters, and sponsors that contribute to INCmty include Bay Area companies such as Google, Facebook, Silicon Valley Bank, and Draper Venture Network. In 2015, Tec de Monterrey established a Silicon Valley International Office at Plug and Play, sending entrepreneurship students each summer. In 2019, the Silicon Valley Office moved to San Jose State University.¹¹

Technology and Innovation Environment

Strategic business clusters in Monterrey include nanotechnology, biotechnology, aeronautics, medical services, automobiles, home appliances, IT and software, multimedia, transport and logistics, agribusiness, energy, and tourism. They build on

varying degrees of R&D intensity and are supported by a structured state system that links government with universities and businesses. Several funds also provide targeted support for entrepreneurs and technology commercialization. **The Nuevo León Innovation Fund** supports science and technology research-based projects with funding of up to US\$200,000 targeting entrepreneurs and new company formation. **The Nuevo León Joint Fund** (supported by the state government and CONACYT) also provides capital for emerging technology businesses but with a critical focus on university partnerships and an active role played by the state's official technology clusters. A third fund, **PROSOFT**, also administered jointly by the state and federal governments, was originally established to support projects that promote competitiveness in the software and IT sector but has recently been opened to other fields.¹²

With its university base, business orientation, and major corporate headquarters, Monterrey is home to a growing entrepreneurial ecosystem. This builds in part on an IT sector that is one of Mexico's largest—Nuevo León accounts for 9.8% of Mexico's IT companies (with Nuevo León, Mexico City, Jalisco, and the state of Mexico together accounting for more than 55% of the sector nationally). Collectively, the state's ICT industry includes approximately 400 companies, more than 100 university programs related to the sector, and US\$1.9 billion in sales.¹³

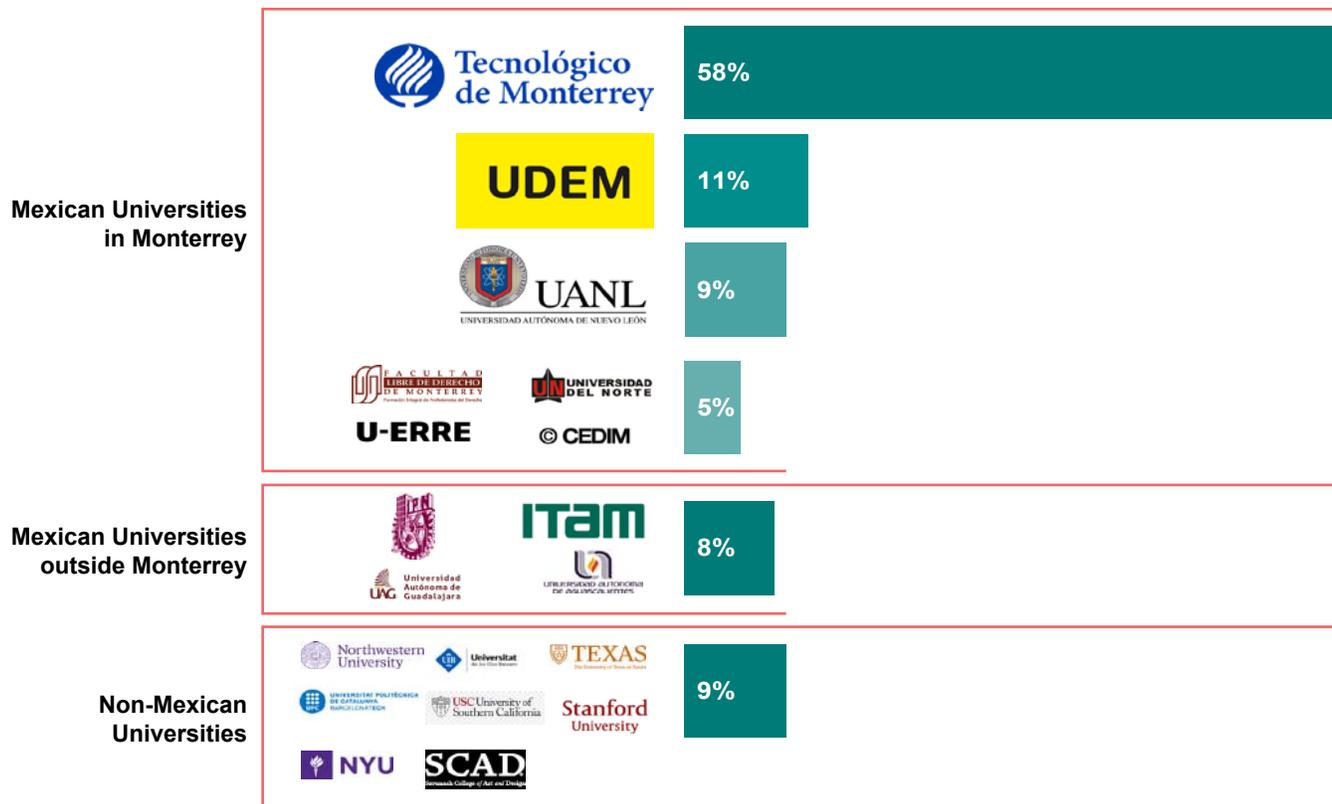
A 2018 analysis by Endeavor Insight found that Monterrey's tech sector included between 300 and 350 entrepreneur-led ICT companies working principally in fields such as software development (SaaS), e-commerce, fintech, and mobile apps/mobile development. Serial entrepreneurship is common, as one in three of these companies has a founder who starts a second company. More than half of SaaS and e-commerce founders have prior experience working at large international tech companies such as Microsoft or Yahoo.¹⁴

Entrepreneurs are supported by angel investors, a nascent venture capital community, and locally based family offices. The dollar value of angel and venture investment is low by US standards but growing; nearly half of angel investment comes from the founders of the city's large tech companies.

EXHIBIT 1

Most tech founders in a recent Monterrey survey had obtained their undergraduate degrees from local universities, particularly Tec de Monterrey.

Undergraduate Degrees of 153 Monterrey Tech Founders Surveyed, 2018



Full List of Universities Included in Each Category

<p>Mexican Universities in Monterrey:</p> <ul style="list-style-type: none"> Tecnológico de Monterrey UDEM UANL Cedim Facultad Libre de Derecho de Monterrey U-ERRE Universidad del Norte Universidad Metropolitana de Monterrey 	<p>Mexican Universities outside Monterrey:</p> <ul style="list-style-type: none"> Instituto Politécnico Nacional Instituto Tecnológico Autónomo de México Tecnológico Nacional de México Universidad Autónoma de Aguascalientes Universidad Autónoma de Guadalajara Universidad Centroccidental Lisandro Alvarado Universidad Mexicana del Noreste, Universidad Tecmilenio Universidad Valle del Fuerte 	<p>Non-Mexican Universities:</p> <ul style="list-style-type: none"> Northwestern University New York University Savannah College Art and Design Stanford University Universidad Austral Universidad Nacional del Rosario Universidad Politécnica de Cataluña Universidad Pontificia Bolivariana Universitat de les Illes Balears University of Waterloo University of Southern California University of Texas.
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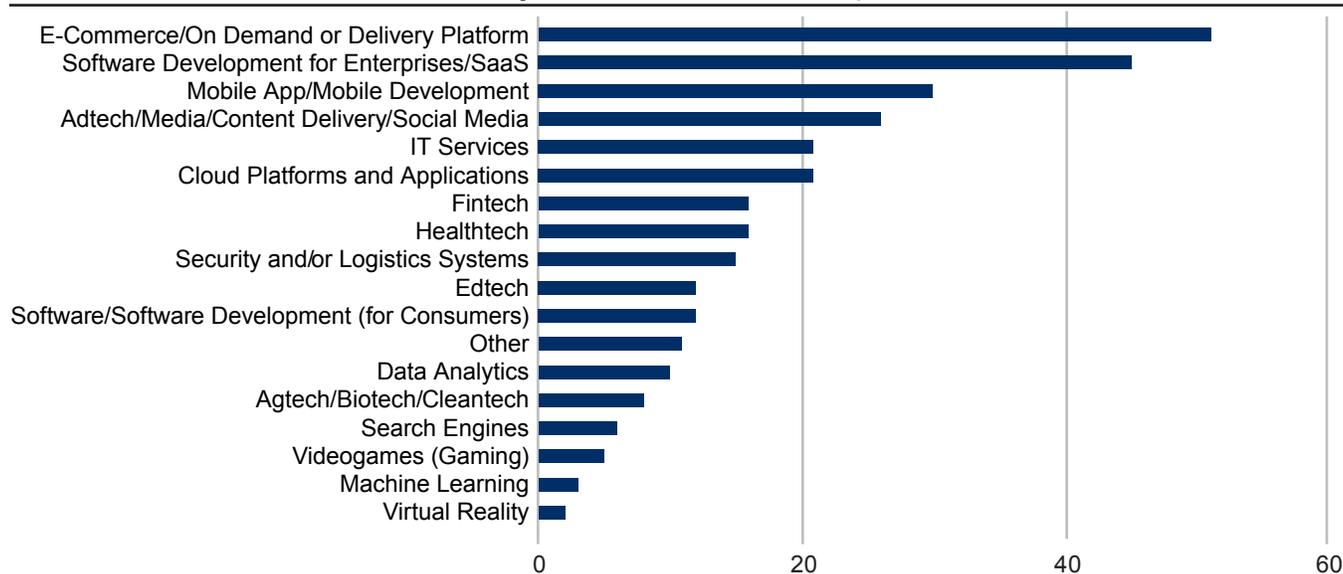
Source: Endeavor Insight

Visualization: Bay Area Council Economic Institute

EXHIBIT 2

In 2018, Monterrey’s tech sector included between 300 and 350 entrepreneurial ICT companies working primarily in fields such as software development/SaaS, e-commerce, fintech, and mobile apps/mobile development.

Breakdown of Industries Within the Monterrey Tech Sector, Number of Companies, 2018

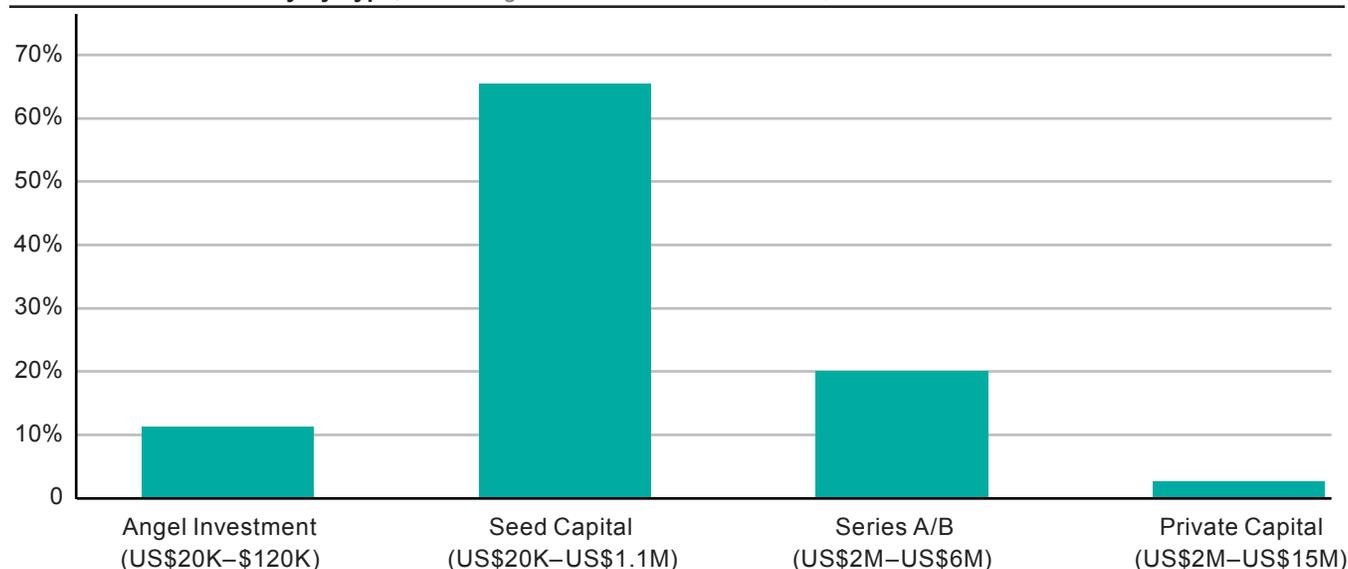


Source: Endeavor Insight analysis

EXHIBIT 3

Investment in Monterrey companies is concentrated at the seed stage.

Investments in Monterrey by Type, Percentage of Total Investment Amount, 2018



Source: Confidential data collected by Endeavor México; Endeavor Insight analysis

As recently as six years ago, venture investment was difficult to find, but it has become easier to secure in the last few years. Early investors included Rogelio de los Santos, co-founder of Dalus Capital and a first mover in the region's venture capital community. Larger corporations headquartered in Monterrey, such as CEMEX, have established corporate venture funds. Other venture firms include Dila Capital, IGNIA, Auria Capital, Grupo Topaz, Stella Maris Partners, Toro Ventures, Startup Studio Monterrey, and Life Is Too Short Capital. Monterrey venture firms primarily invest locally but also have national portfolios. Investment levels tend to be small, with a median of US\$110,000 in local companies and US\$457,500 in national companies, and with the local investment concentrated at the seed stage.¹⁵ In 2019, Nuevo León had 33 venture transactions with US\$40 million invested (an increase of 6.5% over 2018)—the third largest number of venture transactions in Mexico after Mexico City (640 transactions, US\$1,044 million invested) and Jalisco (40 transactions, US\$70 million invested).¹⁶

Monterrey's entrepreneurial support infrastructure also includes a number of networking, guidance, and funding initiatives:

- Founded in association with Tecnológico de Monterrey with the purpose of promoting business growth in Mexico by supporting startups, **Enlace+** is a network of more than 360 entrepreneurship counselors and mentors, which now has 11 branches throughout Mexico. Through its Advisory Councils of leading entrepreneurs, Enlace+ provides mentoring, networking connections, and access to Tec de Monterrey facilities, and it annually awards to qualifying companies a 100% scholarship in its professionalization program.¹⁷
- **Endeavor** is a worldwide NGO founded in 1997 with a mission focused on stimulating global entrepreneurial activity. After opening offices in Chile, Argentina, Brazil, and Uruguay, Endeavor México launched in 2002 with a single office in Mexico City. Since then, Endeavor has opened eight more regional offices across the country, including one in Monterrey. Endeavor connects entrepreneurs with mentoring, strategic advice, introductions, and talent development programs, including tailored education programs at leading universities and an Endeavor MBA fellows program that connects top MBA student teams with startups and growing companies to help them solve business problems.¹⁸
- **Monterrey Digital Hub** is an innovation community campus providing a tech learning ecosystem to help companies bring digital transformation to their industry sectors. It connects member companies through open innovation and corporate entrepreneurial networking programs and offers digital training programs for upskilling and reskilling their workforces.¹⁹ In 2018, global digital consulting services company NEORIS chose the Monterrey Digital Hub as the location for the first in a network of Innovation Labs created to support digital innovation in the manufacturing, financial services, and telecommunications sectors around the world.²⁰
- **Csoftmty**, which is Nuevo León's information and communication technology cluster, has for the last five years hosted an entrepreneur showcase and competition covering health, industry 4.0, lifestyle, fintech, and e-commerce. It also organizes entrepreneur and innovation tech tours to IT companies and innovation spaces (universities, accelerators), in Monterrey as well as Silicon Valley, and offers an innovation training program and diploma.²¹

SPOTLIGHT

CEMEX

CEMEX, a cement and building materials worldwide supplier headquartered in Monterrey and one of Mexico's largest companies, exemplifies the role that leading corporations are playing in the entrepreneurial system. Launched in 2017, the firm's corporate venture arm, CEMEX Ventures, serves as a strategic investment vehicle and provides an open collaborative platform for engaging startups, entrepreneurs, universities, and other stakeholders in the development of sustainable solutions in the construction sector. CEMEX Ventures conducts an annual Construction Startup Competition aimed at entrepreneurs and startups that seek to innovate in the fields of smart cities and buildings; project design and engineering; supply chain management; project and jobsite management; innovative building materials and construction methods; and investment and financing.²²

Winners of the competition are invited to a pitch day and may become part of the CEMEX Ventures portfolio. Startups in the portfolio receive not only investment capital, but also commercialization and expansion assistance through access to industry decision makers, feedback from an industry expert network, and support from an R&D and marketing team.²³ One example among CEMEX Ventures portfolio companies is Ipsum, a Chilean construction project management platform which closed a US\$1 million seed investment round led by CEMEX Ventures and

the Chilean fund Manutara Ventures in 2017.²⁴ Another example is StructionSite Inc., an Oakland, CA-based intelligent construction management tracking software provider, which received a US\$1.5 million seed investment round led by CEMEX Ventures in January 2019.²⁵

CEMEX also fosters sustainability innovation through a range of collaborative efforts. In addition to evaluating its suppliers' compliance with sustainability best practices, it created an INTEGRATE Your Ideas Innovation Program that encourages suppliers to share creative ideas for products, processes, and services that can improve practices across the CEMEX value chain. One such improvement introduced by Volvo (Sweden) is the use of simulators to develop the competence of machine operators. CEMEX's R&D group also works cooperatively with customers to co-create building solutions, such as a concrete facade capable of reducing the temperature of currents traversing it. The firm's CEMEX-Tec Center for Sustainable Communities was founded in 2010 to promote sustainable urban and rural communities through applied research, innovation, and entrepreneurship programs in collaboration with academia and the public and private sectors.²⁶ CEMEX was also among the companies, industry leaders, and academic institutions that developed the Monterrey Digital Hub, which opened in 2018.²⁷

Significant IT and digital technology firms in Monterrey include NEORIS, Infosel, Naranya, and Softtek:

- Founded in 2000 when a technology solutions group was spun off from the CEMEX IT department, **NEORIS** now operates as a Miami-based global business and IT consulting company²⁸ with approximately 4,000 employees,²⁹ including many in Monterrey. As employees have left the firm over time to start their own companies, NEORIS has become one of the largest generators of spin-off startups.
- **Infosel**, founded (as Información Selectiva, SA de CV) in 1988, is one of Mexico's pioneer IT companies. During the 1990s it became the largest internet services company in Mexico. Its co-founder Arturo Galván is among the most influential entrepreneurs in the Mexican ecosystem and is a leading angel investor and mentor. An engineering graduate of Tecnológico de Monterrey and an MBA graduate of Stanford, he co-founded Infosel while working at the local newspaper El Norte, where he identified specific challenges faced by the publishing industry.³⁰ Infosel was launched as a spinoff of the newspaper group and became the first online services company in Mexico as well as the country's largest internet service provider (ISP) and internet portal. In October 1999, the company was acquired by Terra Networks, an internet access and local language content provider for the Spanish and Portuguese-speaking world,³¹ and Terra became the largest internet company in Latin America following its IPO on the Nasdaq the following month.³² In January 2010, Terra sold its shares in the company, which emerged as Infoselective, SA de CV in which the Infosel operation is now located with a focus on providing IT for the financial information services market in Mexico.³³
- In 2002, Arturo Galván, together with his brothers (Ernesto and Carlos) and Javier Salinas Maldonado, went on to create **Naranya**,³⁴ Latin America's first digital innovation studio.³⁵ Naranya works with media, telecommunications, retail, and consumer brands to leverage the digital economy, employing over 200 people³⁶ in 17 Latin American markets³⁷ with a focus on e-commerce, digital marketing, advertising, and content. It also supports Naranya Labs, one of the first corporate accelerators in Mexico working to help startups scale.
- **Softtek**, an IT services company, is Monterrey's largest technology company; with over 12,000 employees worldwide, it accounts for approximately half of Monterrey's tech sector and is active in 20 countries with operations at 30 sites in Latin America, the United States, Europe, and Asia.³⁸ It helps anchor the city's entrepreneurial sector through investment and the large number of employee spinouts and mentors it generates.

EXHIBIT 4

Monterrey has several smaller but fast-growing companies that have the potential to become the next generation of scaled companies.

Monterrey Companies: Significant Recent Funding Rounds

Startup	Sector	Funding Amount	Announced Date	Lead Investors
ePesos	Fintech	US\$6 million	2017	Santander InnoVentures
Nowports	Shipping & logistics	US\$5.3 million	2019	Monashees, Base10 Partners
Skydrop	Shipping & logistics	US\$5 million	2018	Dynamo, Sierra Ventures, Sinai Ventures, Soma Capital, VARIV
Kinedu	Edtech	US\$3 million	2018	IGNIA

Source: Endeavor México and Crunchbase

Monterrey's environment for startups is nascent but promising, with retail and e-commerce, fintech, and healthcare the most active verticals. Newer companies that are seeing success include Enviaflores, a leader in flower delivery, and ePesos, which provides financial services for the unbanked and underbanked in Mexico.

Several case studies exemplify how the city's entrepreneurial assets are being leveraged and the challenges that emerging companies face.

■ **Kinedu**, which focuses on early childhood development, was founded in 2013 by Luis Garza Sada as a mobile app and web platform to provide parents with personalized development roadmaps that encourage early growth and learning. Garza Sada, a graduate of Stanford, was mentored by successful entrepreneurs Arturo Galván of Naranya and Armando Badillo of Eduexperts, received angel investment from Softbank, and has subsequently become an angel investor in his own right, leveraging the Tecnológico de Monterrey ecosystem. Asked about Monterey's environment for startups, he points out that the main advantage to starting a company in Monterrey is access to the well-trained, English-speaking talent that graduates from local universities. The main disadvantage he sees is the competing opportunity for young professionals offered by the city's abundance of corporate jobs at large national and multinational firms.³⁹

■ **Vitau**, co-founded in 2019 by Tuto Assad, is an online pharmacy that allows patients with chronic illnesses like diabetes to receive subscriptions for medications at their homes without having to visit a pharmacy. Assad participated in Y Combinator in the summer of 2019, is scaling Vitau in Monterrey, and has launched the private equity fund Toro Ventures through which he invests internationally in other startups. As he sees it, Monterrey still lacks a strong culture of collaboration and the robust ecosystem which that culture enables. Large corporations dominate the economy, which can divert attention from entrepreneurship. He also sees an upside to the large corporate presence, as Monterey is home to a number of family offices that are gaining new experience working with startups.⁴⁰

■ **Territorium Life**, co-founded by Carlos Guillermo Elizondo in 2013, develops software that helps job seekers identify and develop the skills they need to be hired, by linking job postings with educational service providers. Companies also use its services, provided on a SaaS model, to better understand what kind of training they should invest in. In 2019, the company, with 65 employees, had 3.9 million users in the United States, Mexico, Colombia, and the Dominican Republic. Asked to comment on the environment for entrepreneurs in Monterrey, Elizondo observes that "Monterrey is a city built by entrepreneurs; it's a city of entrepreneurs, where entrepreneurs are respected. Tecnológico de Monterrey was founded by an entrepreneur and the universities here are oriented in that direction." The city is dominated by large industrial companies, he notes, who are looking to invest in new products and services. This is pushing a shift of focus from manufacturing toward creative and other services. Having access to large headquartered companies and their employees helps young companies grow in the region: "In Monterrey it's easier than in other places to get to the president or other top executives of the big companies. They go to Tecnológico de Monterrey and other startup events."⁴¹

Opportunities and Issues

Monterrey stands out in Mexico for its concentration of industry and of large domestic companies. It is also the most business-oriented city in Mexico, with the strongest private sector. Large companies, while based in traditional sectors such as glass and cement, are accelerating their adoption of technology, creating new opportunities for partnerships with overseas companies as well as home-grown startups. For California and Bay Area companies, it offers a production base and market, and also investment opportunities with some of Mexico's major industrial enterprises.

One sector with particular opportunity for further development and binational cooperation is energy—and renewable energy in particular. Nuevo León has 301 MW of installed generating capacity, of which 18,266 is from renewable sources. State leaders see great

potential for the development of increased production from solar, wind, biomass, and geothermal sources.⁴² Stanford University is collaborating with university, NGO, government, and industry partners to identify and catalyze these opportunities through its Mexico Clean Economy 2050 project, launched with the support of the United States Agency for International Development (USAID).

Technology companies specifically look to Monterrey as a source of engineering talent. It also offers a market and investment platform for emerging Mexican companies. One reason often given by local entrepreneurs for starting their companies in Monterrey is the city's market and networks of clients and suppliers, and the access to customers they provide. Corporate leaders also directly support the entrepreneurial community by investing in startups.

The city's technology and startup ecosystem faces ongoing challenges. Despite the significant increase in the number of tech companies, reaching scale is difficult, and tech employment concentrates in the city's three leading tech companies. Fewer than 20 entrepreneur-led

companies (which together account for 80% of the sector's employment) have 100 or more employees. This points to the related challenge that as it seeks to grow more and larger technology companies, Monterrey needs to hold more entrepreneurs and engineers in the region. Founders point to human capital as their most serious challenge, as they compete for technical talent with both local companies and companies in the US.⁴³

One strategy for meeting this challenge is to develop a deeper focus on enabling the growth of later-stage companies through greater collaboration between universities, corporations, and venture capitalists, including an upward shift of venture activity toward later-stage investment. In that process, Tec de Monterrey, which anchors the region's technology and entrepreneurial communities, is a unique asset.

Despite its economic importance in Mexico, Monterrey has not yet attracted significant attention from Bay Area and California companies or investors, who focus primarily on opportunities in Guadalajara and Mexico City.

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Baha California

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