



TECHNOLOGY
TRANSFER

WHY CAN'T MEXICO MAKE SCIENCE PAY OFF?

The nation is poised to explode into the information economy—and yet stubbornly refuses to do so

By Erik Vance

IN 2008 IT SEEMED LIKE Enrique Reynaud had the world in his back pocket. A veteran professor of molecular biology at Mexico's largest and most important university, he was about to start his first company, Biohominis. It was a kind of Mexican 23andMe—a laboratory that could offer insight into a customer's genetic proclivity to hypertension, diabetes and other diseases.

In many ways, Biohominis was the culmination of Mexico's biotech tradition, which goes back to Norman Bor-

laug, who kicked off a green revolution around Texcoco. Biohominis was based in part on innovative applications of the polymerase chain reactions used in genetic testing and was developing techniques to identify cancers, metabolic problems, and viruses in humans and livestock.

To do this, Biohominis assembled a dream team of geneticists. María Teresa Tusié Luna, an expert in the genetics of type 2 diabetes—an epidemic whose proportions in Mexico rival only the U.S.—was an adviser. Isabel Tusié Luna, an expert in the genetics of brain damage who has published in *Nature Biotechnology*, was chief operations officer. And Eduardo Valencia Rodríguez, founder of one of Mexico's biggest construction companies that builds pharmaceutical facilities, was in charge of running the business side.

Even the Mexican government had gotten behind the firm. For years prior to its founding, government officials pri-

vately had been telling Reynaud that companies like Biohominis are exactly what Mexico needs to reposition itself as a technological leader rather than a source of cheap labor. The government even backed up this encouragement with cash, contributing \$500,000 or so to kick-start the business.

It was not enough. Mexico, in the end, was cruel to Reynaud and his colleagues. Two years after getting its start, Biohominis filed for bankruptcy. The members of the dream team went their separate ways.

gest in the Western Hemisphere, with more than 300,000 students, and has a healthy research arm. According to government figures, 130,000 engineers and technicians graduate from Mexican schools every year. Mexican scientists invented an early color television and the birth-control pill and helped to identify the ozone hole.

And yet in almost every measurable way, Mexico's once dominant science institutions have stood still as those in other countries pass them by. Argentina and Chile are nipping at its heels. Brazil

beginning, when an invention is only a germ of an idea; in the middle, when scientists and engineers set out to form the company that will bring an idea to fruition; and at the end, when an idea fails and it is time to begin again. Biohominis ran into problems in the middle stage, so we will start there first.

STUCK IN THE MIDDLE

BY THE TIME REYNAUD and his partners had spent the money the federal government had given them, they were making money selling a few solid products. They looked to private investors to keep them afloat until they were stable. But there was no one to fund them. Most investment companies could not grasp what Biohominis had to offer. "When they hear 'technology,' they think we are in Bangalore and we are doing software. They want software factories because that's what they understand. They want trucking companies and logistic companies," Reynaud says. "They love service companies. If you want to get money from an investor in Mexico, get a crew for mopping floors—they understand that kind of business."

Lack of cash is not the main problem. Mexico's \$1.2-trillion economy—the world's 10th largest—has seen remarkable repeated growth of at least 3.5 percent a year. Carlos Slim, the wealthiest man in the world, is Mexican. Yet the few companies that expressed interest wanted guarantees of 20 percent annual profit margins—a steep price in any market but especially hard for a start-up—or large ownership stakes.

The kind of financing that Reynaud was offered was not venture capitalism as we know it in the U.S. In California and elsewhere, venture capitalists are the glue that brings ideas together and the grease that keeps things moving. They understand the science of their field and make connections in labs and university departments. Crucially, they gamble on lots of companies at the same time—most of which will never make it—and simply walk away if they fail. Mexico's private funding is not set up this way. Today there are just 15 or so venture-capital funds in Mexico. This is an improvement on the two there were in 2008, but only four could be considered serious players. All told, the firms invested \$469 million in 25 projects in

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How could a company that had so much going for it come to such a disappointing end? The case of Biohominis shows how difficult it is to instill a culture of innovation in a country that in many ways is the antithesis of the open-minded, meritocratic Silicon Valley way of operating. Despite its vibrant scientific research community, Mexico so far has not managed to translate its knowledge and talent into local products, technologies and start-ups. Mexico is not the only middle-income nation struggling to break free from a cycle of sweatshops and huge wealth disparities. But perhaps more than any emerging country, Mexico is and has been poised to explode into the information economy—and yet stubbornly refuses to do so.

VIBRANT AND BOGGED DOWN

MEXICO'S ECONOMY has baffled development experts for years. The National Autonomous University of Mexico (UNAM)—often credited with creating Mexico's middle class—is one of the big-

spends three times as much on science and technology, and its universities are now ranked higher than Mexico's. South Korea sends 10 times as many students per capita to U.S. universities, and Turkey publishes almost twice as much. Meanwhile a horrendous drug war has ripped the north of Mexico to shreds, corruption is rampant, and patents and new businesses are at a slow drip.

This schizophrenic quality of Mexican innovation—at once dynamic and bogged down—was a big part of recently elected Enrique Peña Nieto's presidential platform. He has promised a more technological Mexico, one that cultivates an innovation-focused, knowledge-based economy. He plans to start with cash—Mexico spends a paltry 0.4 percent of its gross domestic product on science and technology. The U.S. spends seven times as much of its GDP.

But Mexico's innovation dysfunction is deeper and more widespread than just money. Innovation in Mexico gets stopped in three different stages: at the

TOP ECONOMIES, 2013*

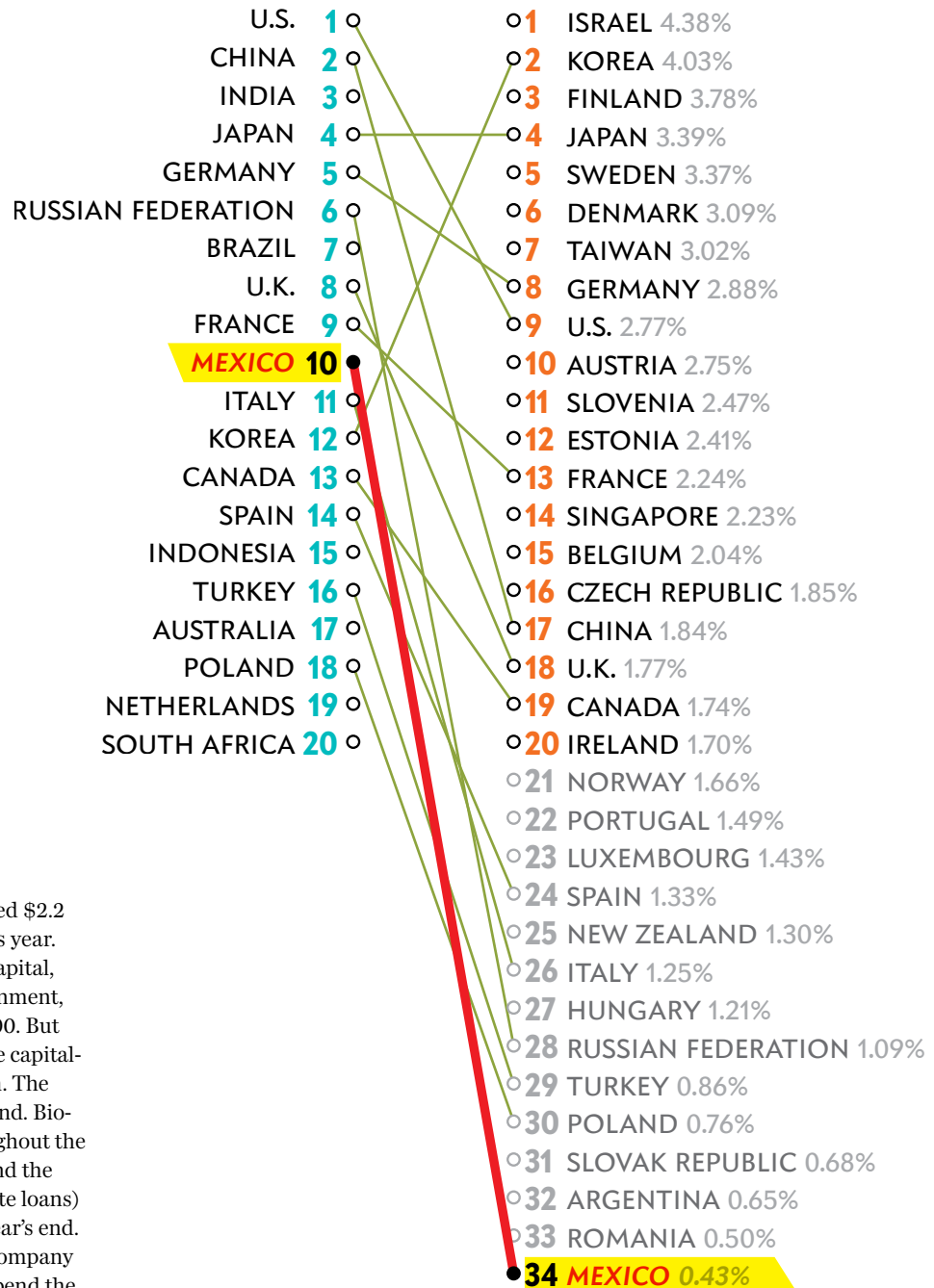
PERCENT OF GDP
SPENT ON R&D, 2011†

FALLING BEHIND:

Mexico has the world's 10th-largest economy, and it is growing at a rate of at least 3.5 percent per year. Yet the country spends only a tiny fraction of its gross domestic product on research and development, even less than economically troubled nations such as Spain and Italy.

*According to the OECD Research and Development Statistics (RDS) database, which is made up primarily of OECD member countries. Economy ranking is based on 2005 purchasing power parity. Certain provisions apply.

† Data for 2011 not available for several economies.



2011. The Bay Area alone invested \$2.2 billion in the first quarter of this year.

Stymied in seeking venture capital, Reynaud went back to the government, which provided another \$500,000. But governments are terrible venture capitalists, and Mexico's is no exception. The money was bizarrely hard to spend. Biohominis paid its own bills throughout the year (much of which Reynaud and the other owners covered with private loans) and then got reimbursed near year's end. To avoid horrendous taxes, the company had just a couple of months to spend the entire year's worth of money. It could spend that money only on lab research and not general operations. And even then, Biohominis had to pay taxes that would later be reimbursed.

Massive companies such as Nestlé or telecom giant Telmex can incorporate grants like this into bloated R&D budgets and could care less about payment schedules. But for a nimble start-up liv-

ing month to month, these restrictions were death. Reynaud could not spend the money fast enough while simultaneously getting buried under debt to cover his operating costs.

Despite the support and expertise and a growing stream of income, Biohominis shut down for good in December 2012. In

the end, it was not so much the product or the management or the market that killed it as a government that was clumsily trying to help. The death of Biohominis was slow and sad, bled out by cuts from 1,000 pieces of red tape.

"UNAM has incredibly good scientists. But there is nobody to make the

link, the bridge building and the match-making, who understands the technical side and then understands the business side. That's the uniqueness of the venture capitalists," says Carlos Santacruz, an investor who has worked in both Silicon Valley and Mexico.

STALLED AT THE START

IN SOME WAYS, Biohominis was lucky. At least it had investors and something of a business going before it ran aground. Many ventures do not even get that far, because they run into a cultural impediment: a mistrust of homegrown technology and an inferiority complex concerning their neighbors to the north.

When Mexican companies need research to solve a problem, they tend to look to U.S. or European companies for solutions. "There is this myth that has been created that we can't develop technology in Mexico," says Pilar Aguilar, director of Endeavor Mexico, the Mexican branch of the Endeavor Global organization, which promotes innovation in the developing world. "We've seen very innovative technologies based on chemical processes or in artificial intelligence. And the first reaction we get many times [from Mexican businesses] is, 'Really? Are we doing that in Mexico? Is that even possible?' We are used to thinking that the best technology comes from somewhere else."

Similarly, Mexican scientists with new ideas tend to start companies abroad before bringing them home. That is what Horatio Montes de Oca did. A few years ago Montes de Oca, a physicist whose undergraduate education was in Mexico but who is currently living in Ireland, came up with a material that he thought might be used in tendon or ligament repair and reconstruction (he declined to give specific details). He decided he wanted to develop the idea through a Mexican university laboratory in the state of Querétaro.

But the university had no idea how to work with him. There were no procedures or rules to partner with an outside entrepreneur, and it would take years to set them up. He got the same answer from other universities in Mexico. Montes de Oca, whose parents were academics, more or less just shrugged his shoulders. "The academic institutions in Mexico are not created and are not there

to replicate [a capitalist] system," he says. "When you are an entrepreneur, you have to make a decision and say, 'This is not going to happen. I wish I could do it in Mexico, but I can't wait five years to develop it.'"

Eventually Montes de Oca partnered with a British lab to develop his invention. It is a predictable story—one of the hundreds of thousands of Mexican researchers living outside the country has a big idea and, in a fit of sentimentality, patriotism or homesickness, tries to

see this every day. In the early 1990s Marin helped to identify Chicxulub—a massive crater off the Yucatán Peninsula—as the impact site of the asteroid that killed the dinosaurs. Today he publishes more than three papers a year—eight times the university average, he says—and runs a side business contracting with companies such as Coca-Cola looking for groundwater for making soda. As his business has grown, his colleagues have ostracized him. After years of working with the corporation privately, he tried to

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bring the idea home. But a series of obstacles pushes them back to the U.S. and Europe.

In most of Mexico, the idea that universities should help industry—either with research or by fostering new companies—is new and not terribly popular. In fact, professors are paid based on seniority and the papers they publish, with no incentives to patent or start businesses. And even if they patent, enforcement is so lax that another lab can just take the idea. As a result, most research is highly theoretical, and the government looks to other countries for things such as flu vaccines, as it did during the 2009 H1N1 outbreak.

Luis Marin, a UNAM geophysicist,

bring the project under the umbrella of the university. But by the time every office took its cut, about half his budget was going to administrative fees. So he streamlined the idea and ran it directly through the office of the president. Colleagues lined up against him to say he was trying to cheat individual departments. After 23 years at the school, he got his first bad performance review, which determines his pay for the next year.

Shaking his head in his cozy office in the south of Mexico City, he says it is not clear he will be there for another year. He recalls that Harry Steenbock, the University of Wisconsin scientist who in 1923 irradiated foods, added vitamin D to them and helped to cure the disease

rickets, patented the technology and used the massive windfall for more research. “That’s where we need to move. But if I want to spend some time on these things, I get punished. Forget breaking even—I get punished,” he says. “There’s no clear financial gain as a scientist to patent something. You make less money and are not well [regarded] by your peers.”

RISK-AVERSE CULTURE

PERHAPS THE BIGGEST obstacle Mexico must overcome is an intolerance of risk. In California’s Silicon Valley, failure is considered a stepping-stone to later success. In Mexico, “people here feel that when they start investing in companies that they need to be like the next big families of Mexico, where every investment is going to turn around and become one of the huge companies of Mexico,” says Pablo Slough, head of Google Mexico. “It doesn’t work that way. That’s what I think is missing—that kind of middle-of-the-road, let’s-bet-on-things attitude.”

The Google office in Mexico is a small slice of dot-com California, bizarrely out of place in conservative Mexico. Slough is a smooth, charismatic speaker who dresses and acts every bit the Silicon Valley entrepreneur. He is Argentine by birth but invests regularly in Mexican companies almost as a matter of principle. Slough says, historically, the country’s biggest companies have been either tied to government (such as oil giant Pemex) or are former government monopolies that subtly morph into corporate monopolies (such as Telmex). This skewed market, he says, creates an investment culture that irrationally expects guaranteed returns.

Recently Slough invested in a small outfit that created portable, inflatable playgrounds for children. When the company did not work out, he shrugged and moved on to the next investment. But he was shocked at what the other investors said to the two young Stanford University graduates who started the company. “They were berated,” he says. “This risk of failure is a big deal here. In the U.S., you can start a company, it fails—who [cares]? Start another one.”

Perhaps for this reason, the Mexican stock exchange has seen just 17 companies release initial public offerings in the

past five years. In contrast, in the first half of this year, the New York Stock Exchange had released 85.

Absent or antagonistic investors, maddening red tape and an antirisk business culture are why Mexico has one of the most profound brain drains in the world. Mexico sends more undergraduates and grad students to the U.S. than any Latin American country. But when talent goes abroad, there is a chance it will not come back. One study suggested more than 70 percent of Mexican Ph.D.s end up leaving.

The Peña Nieto government has identified this problem. During the 2012 campaign, representatives said they planned to reach out to several active researcher/expat networks to enlist the help of Mexicans living abroad to either partner with them or even lure a few back home. Except at the very top universities and laboratories, Mexico cannot compete with the salaries and resources that scientists find in the U.S. “If I could work in a research center in Mexico that would allow me to do the things I am doing, the things I did in my Ph.D. or the things I want to accomplish, I would have stayed in Mexico,” says Pablo Mendoza, president of the Mexican Talent Network–U.K. “If we could have the possibility to return to something that would have the potential that you see in other countries, many of us would come back.”

The diaspora may indeed be the country’s greatest asset. Every Mexican scientist I spoke to said he or she hoped to go home someday to support Mexican science. Dozens of expat associations, akin to Mendoza’s, link Mexican researchers and entrepreneurs from New Zealand to Germany.

GREEN SHOOTS

TRUE TO MEXICO’S schizophrenic nature, it is also producing an increasing number of success stories. According to the *New York Times*, in 2012 Mexico was among the largest exporters of IT services in the world, just behind India,

the Philippines and China. People such as Blanca Treviño, CEO of the international IT firm Softtek, are convinced that Mexico is on the verge of a blossoming information economy.

In Mexico, research hubs—such as the biotech one in Cuernavaca and an automotive engineering one in Toluca—are partially directed by CONACYT (pronounced CONE-a-SEET), Mexico’s primary science-funding arm (analogous to the U.S. National Science Foundation). Although some argue that government cannot dictate innovation, many CONACYT centers have overcome the start-up obstacles Montes de Oca and Reynaud faced. Indeed, whereas Mexico will likely have to rely on the U.S. for the next swine flu vaccine, the U.S. will soon be relying on Mexico for such medical products as scorpion and spider antivenom.

Mexico’s future may come down to how successfully Peña Nieto is in his campaign to promote innovation. He has positioned himself as a kind of fresh, Silicon Valley leader. At the same time, however, he brought a party to power that ruled with a tight fist for more than 70 years, doling out CONACYT money for political favors—the antithesis of the meritocratic, entrepreneurial values of Silicon Valley.

But Peña Nieto is not the whole story. In greater numbers, Mexicans are breaking away from the government-as-a-guide model and striking out with new ideas. And increasingly they are whittling away the obstacles. Reynaud, for one, is not ready to give up. “Three and a half years that we operated at full scale, we made probably a million and a half pesos [around \$115,000],” he says. “We were very close to getting out of the Valley of Death,” referring to the gap between the laboratory and the market.

Would he do it again? “Yes,” he says. “Yes, I would if I had the right idea. I’ve learned so much, and next time it will be different.” Then he lets out a nervous laugh. ■

Erik Vance is a science writer based in Mexico City.

MORE TO EXPLORE

A Special Report on Mexico: From Darkness, Dawn. *The Economist*; November 24, 2012. www.economist.com/news/special-report/21566773-after-years-underachievement-and-rising-violence-mexico-last-beginning

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