A VENTURE UNDER PRESSURE

Scientific innovation has long powered the San Francisco Bay Area's economy, but community and political challenges could undermine progress.

KATHERINE BOURZAC

From the integrated circuit to synthetic insulin, mail-order genetic tests and ride sharing, scientific discoveries and technologies developed by researchers and engineers in the San Francisco Bay Area have fuelled the local economy for decades.

But while politicians and urban planners around the world try to emulate the Bay Area's path to economic success through research prowess, locals and social scientists are asking whether the region's model of growth is sustainable. The Bay Area is burdened by the high cost of housing, income inequality, homelessness, gridlocked traffic, and inadequate public transportation. These threaten to undermine the region's status as an economic dynamo. "The viability of the innovation economy is in question," says Benjamin Grant, a director at the non-profit San Francisco Bay Area Planning and Urban Research Association (SPUR).

"The problems the Bay Area is facing are the problems of success," says Grant. The northern California metropolis is among the top 50 science cities in the Nature Index, measured by its contribution to the authorship of 82 high-quality research journals. When assessed solely on the output of its corporate institutions, it ranks number one. The question is whether the Bay Area can, in the face of mounting social problems, retain these companies and the brilliant researchers whose work they depend on.

NETWORK EFFECTS

In the 1970s, the Boston area, with its prestigious universities and long-established corporations, would have been a good bet to become the tech industry hub, says AnnaLee Saxenian, a political scientist and dean of the School of Information at the University of California, Berkeley. But an unusual culture in the Bay Area of open exchange between researchers, companies and universities, as well as strong ties to venture capital, she says, fostered science and engineering research, particularly in Silicon Valley. This sharing and information free-flow arose, in part, from the values of the 1960s hippie counterculture, which was centred in San Francisco.

"Engineers were reacting against the

COURTESY OF GENENTECH, A MEMBER OF THE ROCHE GROUP

A cold room at Genentech. The biotech giant is one of the Bay Area's major employers.

corporate culture of the east coast," says Saxenian. Talented scientists and engineers came to the Bay Area from around the world to have access to networks, prototyping and venture funds. And venture capitalists looking for the next big thing, says Saxenian, found it in labs at Stanford University, and at the University of California's campuses in San Francisco, Davis and Berkeley.

The city has attracted many high-achieving scientists in the natural sciences. Zora Modrusan, who develops gene sequencing and analysis techniques at the biotech company Genentech, says the strength of the biotech industry drew her to the Bay Area from Canada 19 years ago. "It's very dynamic and interactive," she says. Since 2015, Modrusan has co-authored some 20 articles in the index journals, developing methods for analysing the functional significance of genetic changes in cancer and other diseases. Her current work seeks insights into the heterogeneity within tumours.

James Hedrick, a materials scientist at IBM Research–Almaden in San Jose, says his work has benefited from exchanges with the region's biologists, machine-learning experts, and catalysis chemists. Hedrick engineers new polymers and has co-authored more than a dozen articles in index journals over the past three years. Initially, IBM was using these materials in part of its chip-making process; now, Hedrick is developing them for devices to deliver targeted drug therapies.

BACKLASH

If you ask a local in San Francisco, you might hear a different take on what the Bay Area's booming innovation economy means: inadequate public transportation and gridlocked traffic (made all the more galling by the privately owned 'tech buses' pulling into public bus stops), growing income inequality, the displacement of communities of colour, and homelessness.

Perhaps the most severe challenge in the region is housing. Real estate company Zillow estimates that the median monthly price for a two-bedroom rental in San Francisco averages US$4,130, towering over the nationwide average of US$1,442, and more than a thousand dollars above New York and Boston. At last count, in January 2017, there were 7,499 homeless people in the city; these numbers have remained fairly steady since 2013.

Grant says the current crop of innovation-driven companies has failed to engage with these civic problems. For better or for worse, he says, "the world of research and innovation has been a world apart in California."

Although the tech industry has increased demand for housing and driven up prices, it does not carry the full blame for the city's social ills, says Alex Schafran, a geographer at the University of Leeds, in the United Kingdom, who studies California's housing crisis.

Broader cultural forces and political failures have contributed. Most people agree that the Bay Area needs more housing, but no one wants tall buildings to go up in their own neighbourhoods, says Grant. And under California's system of government, even if regional planning authorities agree on the need for more housing and public transit, local communities can veto such construction. Building outside developed areas is restricted by conservation regulations that protect large swaths of park lands.

These woes are eroding quality of life in the Bay Area, says Grant, and making it ever more difficult for companies and universities to hire and retain the best researchers and students. Companies are also beginning to move elsewhere, he says. As further evidence of the trend, San Francisco's output in the index has declined in recent years, from a fractional count of 1,723.8 in 2012 to 1,676.35 in 2017.

Such regional declines are hardly unprecedented. "At one time Detroit was the centre of innovation in the United States, and Detroit collapsed," says Grant. But he sees hope in moves by state legislators. California Senate Bill 827, introduced in January 2018 by San Francisco's State Senator Scott Wiener, would have enabled the construction of more housing near public transportation hubs. The bill didn't pass, but that it was even proposed is a sign that the tides may be shifting, says Grant.

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Saxenian is more reserved in her projections, and for good reason. Her first paper about Silicon Valley predicted that the high cost of living would drive the tech industry out of the area. That was in the 1980s. "I was wrong," she says. The same conditions that drove the development of the Bay Area's strong culture of scientific innovation make it resilient.

Saxenian sees other threats to research innovation in the Bay Area: repeated cuts to the University of California's budget, and restrictive immigration policies, in particular. "Immigration has been beneficial both to the Bay Area and to other countries," says Saxenian, who has written a book (*The New Argonauts*) on the subject. "Talent goes both ways," she says. But this mutual benefit gets lost in the national political conversation.

Schafran, who grew up in the Bay Area, says researchers and engineers need to get more involved in addressing its social ills — but there are no quick fixes. Since they've been building for decades, "it's gonna take another 30 years to get ourselves out of it," he says. "We can't do this overnight." If researchers remain detached and don't think locally, it could be to their own detriment. "You may be on the top of the world for the moment, but don't get too comfortable," says Grant. ■

SAN FRANCISCO

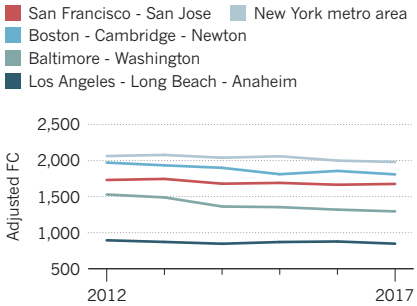
SHARE OF COUNTRY'S FRACTIONAL COUNT (FC) 2017: 8.5%

TOP 3 INSTITUTIONS (FC 2017):

1. Stanford University: 610.47
2. University of California, Berkeley : 411.70
3. Lawrence Berkeley National Laboratory: 187.93

TOP US CITIES

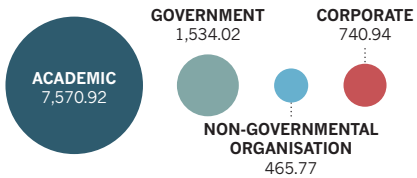
San Francisco – San Jose is the third leading science city in the United States, measured by fractional count (FC) in 2017.



SOURCE: NATURE INDEX; SOURCE FOR 'TOP FIELDS': NATURE INDEX/DIMENSIONS FROM DIGITAL SCIENCE

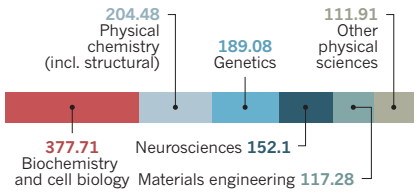
SCIENCE SECTORS

Corporate institutions contribute a relatively large share of San Francisco's authorship in the index, measured by fractional count (FC) 2012–2017.



TOP FIELDS

Below are the top 6 fields that researchers in San Francisco contribute to in the index, measured by fractional count (FC) 2015–2017.



CHOICE JOURNALS

San Francisco-based researchers contribute more articles (AC) to the *Proceedings of the National Academy of Sciences, USA* than to any other journal in the index. In this journal, they account for 54% of the authorship (FC) of papers to which they contribute.