

A prop at a Google event to promote AI. The company has huge pulling power.

## Are tech giants hoarding AI expertise?

The flow of top researchers to industry brings challenges and opportunity. **By Chris Woolston**

**B**ig tech companies' drive to embrace the possibilities of artificial intelligence (AI) and their custody of this burgeoning technology is a growing source of societal and political debate. The natural wish of such firms to attract the best researchers could be causing a fundamental problem. According to two scientists involved in separate projects tracking researcher mobility between academia and industry, talent is slowly leaching from the public to the private

sphere, threatening competition, intellectual freedom and the future of AI innovation.

In one study, published as a preprint in arXiv in 2021 (R. Jurowetzki *et al.* Preprint at <https://arxiv.org/abs/2102.01648>; 2021), the authors used researcher affiliations in nearly 800,000 AI papers, published between 2000 and 2020, to show how the flow of top researchers from academia to industry has grown steadily over the past decade. In 2019, they identified more than 400 researchers whose affiliation changed from

a university to a tech company, compared with just over 200 researchers who switched from industry to academia. The authors are revising the paper with plans to submit it for peer review.

Researchers who move into industry tend to be especially productive and influential leaders of the field, says Roman Jurowetzki, a data scientist at Aalborg University in Denmark and the paper's lead author. The study found that researchers who make the switch had more than three times as many citations per paper before leaving (4.2) than those who stay behind (1.3). "One could speculate that industrial labs are targeting impactful people and taking them out at their peaks," Jurowetzki says.

Once those researchers leave academia, their impact as measured by paper citations tends to plateau or slightly decline. On average, their citation rating relative to their peers dropped by about 1% for every year they spent doing research out of academia – a trend that Jurowetzki and co-authors believe reflects different priorities in the two sectors. As Jurowetzki explains, researchers at big tech companies often continue publishing, but the papers tend to be more circumspect and constructed to protect intellectual property, including the exact methods used to analyse a data set. The result, the authors of the paper say, is a potential "privatization" of knowledge.

Commercial organizations tend to publish far fewer AI papers in the 82 leading natural-science journals tracked by the Nature Index than their academic counterparts. Only Alphabet, Google's parent company, had a Share – a fractional count of authorship affiliations in the Index – between 2015 and 2021 that placed it in the top 100 institutions overall. This raises questions about the frequency with which research involving the corporate sector is making it into the public domain.

AI researchers might also lose some intellectual freedom when moving to a big tech company, Jurowetzki says. In their paper, he and co-authors point to the "critical requirement" of maintaining a "public sphere" for AI research that does not have to "balance academic integrity with commercial interests". The size and influence of this public sphere could be "threatened by the sustained flow of researchers from academia to industry", they warn.

"When you have these large organizations defining the standards, it's problematic from an ethics perspective," Jurowetzki says. However, he points out that academic freedom dilemmas are not confined to industry; in academia researchers might have to balance intellectual inquiry with ensuring they can seek funding for their project, for instance.

There are also questions about the longer-term damage caused to academia by lost

DAVID PAUL MORRIS/BLOOMBERG VIA GETTY

expertise. In a 2022 study, economists Michael Gofman, of The Hebrew University of Jerusalem, Israel, and Zhao Jin, of the Cheung Kong Graduate School of Business in Beijing, China, tracked 211 AI researchers in North America who went from academia to industry. The paper, forthcoming in the *Journal of Finance* (M. Gofman and Z. Jin, Preprint at SSRN <https://doi.org/jfxh>; 2022), found that students from universities that lose an AI researcher to industry tend to create 5% fewer start-up companies for up to six years after a researcher leaves.

“You have researchers who are very innovative and productive, but they are not preparing the armies of future generations of innovators,” Gofman says. “Are we sacrificing long-term growth because a university cannot compete with Google?” A closer look at the numbers showed that the impact was especially pronounced in the AI sub-field of deep learning, a burgeoning discipline where a leading researcher’s knowledge could be very valuable to the next generation of students.

Gofman and Jin determined that 70 of the 211 researchers who left their academic positions maintained some sort of university affiliation. Such dual appointments are increasingly common, but they are a mixed blessing for universities; the data suggest an even greater decline in future start-ups when a researcher maintains a university affiliation instead of cutting ties completely. Gofman says this could be because researchers who leave completely can be fully replaced, which could be potentially better for the institution than having a part-time academic.

Whatever the terms of their departure, AI researchers who quit academia leave big shoes to fill: Gofman and Jin estimate they accounted for nearly 20% of the citations for their entire department in 2018. “Google, Apple and Facebook are taking people who got a boost in their citations because they are doing the cutting-edge stuff,” Gofman says.

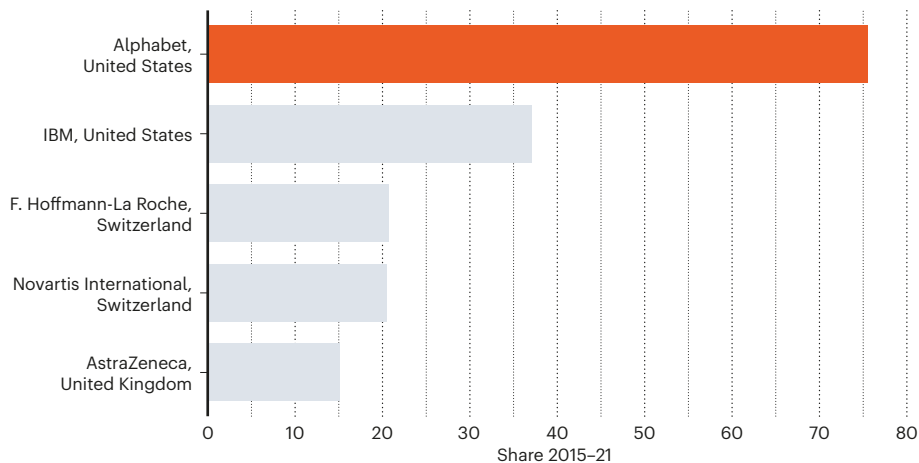
It’s perhaps not surprising that so many AI researchers are making the switch, says Terah Lyons, a policy analyst at Stanford University, California. Compensation is one obvious factor. According to website Glassdoor.com, which collects anonymized data on remuneration in different companies, the median total annual pay, including additional payments such as bonuses, for a senior scientist at Google is estimated to be around US\$274,000. But Lyons says a prominent AI researcher could demand significantly more. “The packages being offered by companies are almost inconceivable and make it really hard for people to say no,” Lyons says. “It’s also very hard for academic organizations to compete.”

Another appeal is the opportunity to work on

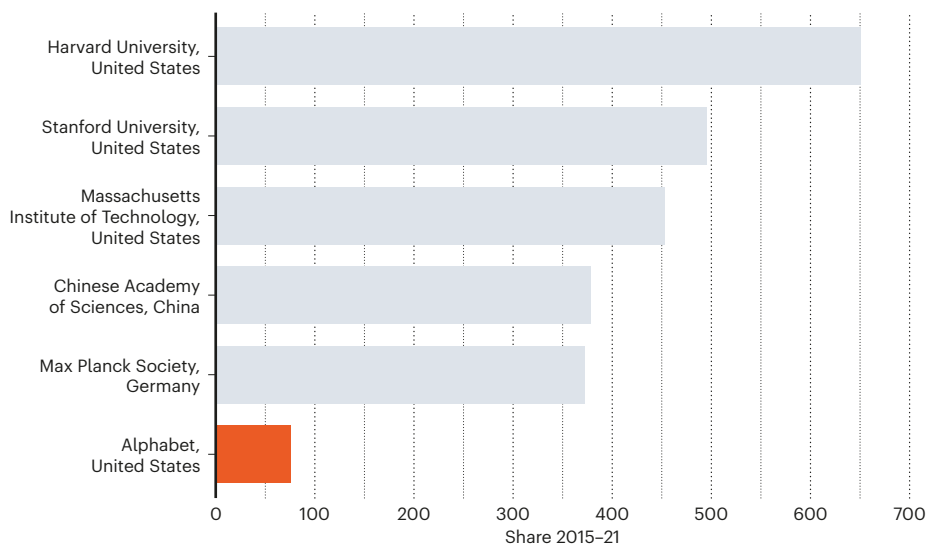
## THE ACADEMIA AND INDUSTRY IMBALANCE

Alphabet is the company with the largest Share in the Nature Index by a large margin, but it is dwarfed by the Shares of leading academic institutions. This neatly illustrates the differences in AI and robotics research output between the two sectors.

Leading corporate institutions in AI and robotics, 2015–21



Leading institutions in AI and robotics compared to Alphabet, 2015–21



the type of large proprietary data sets – including user data and search data – that can only be found at large companies, Lyons says. More fundamentally, some AI researchers simply want a change of scenery. “A lot of researchers tire of the politics of academia,” she says. “When you’re offered a leadership position in an industrial research context, that can be attractive.”

Lyons, who was a policy adviser at the White House Office of Science and Technology Policy in the final two years of US president Barack Obama’s administration, says that greater public investment in AI education could help to stem the brain drain and reduce some of the disparities between academia and industry. But she adds that the exchange of researchers between the sectors can, if handled correctly, also bring huge positives such as new

opportunities for collaboration. She notes that researchers don’t completely cut ties with their academic colleagues when they leave. Because of that cross-pollination, companies have new access to academic collaborators and universities have new possibilities for corporate partnerships.

“Having those ideas flow across sectors is potentially pretty powerful,” says Lyons, who in 2016 co-founded Partnership in AI, a global non-profit organization that promotes cooperation between academia and industry. “The whole idea is that you need a diversity of voices sitting around the table. There’s a role for every one of these sectors to play.”

**Chris Woolston** is a freelance writer in Billings, Montana.