





Trade secrets: industry's publishing dilemma

There are good commercial reasons for firms to share their research in science journals, but the data suggest it is a strategy on the wane. **By Brian Owens**

Academic research might lay the groundwork for modern technology, but the products we use daily are often shaped by innovations from corporate labs. Unlike in academia, where publishing is central to progress, corporate research tends to prioritize secrecy – protecting discoveries to maintain a competitive edge. That is not to say that companies don't disseminate the results of their research. Results are often shared in company annual reports, investor prospectuses and white papers. And US publicly traded firms produce around 30,000 peer-reviewed scientific publications a year, says Dror Shvadron, a researcher at the University of Toronto in Canada who studies how companies approach scientific research. "It's a big activity that firms are involved in," he says.

But even that relatively large number of publications represents a small fraction of the research that firms do. Amazon, for example, has a research and development (R&D) budget of about US\$85 billion, says Jungkyu Suh, an economist at New York University. In 2024, the company published just over 200 research articles that were indexed in the Web of Science database, owned by analytics firm Clarivate.

Data prepared for Nature Index by Sydney-based firm League of Scholars, which tracks recruitment across the public and private research sectors, suggest that other big-tech companies, such as Apple and Meta, are even less likely to publish, despite being among the top ten corporations globally for researcher headcount (see 'Papers vs patents').

This trend is due in part to a change in how companies approach science, especially in the United States, says Suh. In the first part of the twentieth century, firms tended to invest heavily in science in areas where US academia was lagging behind Europe, such as organic chemistry, polymers and electrical engineering. "AT&T Bell Labs, Dupont Experimental Station, Kodak Research Labs, were all huge labs that dwarfed what American universities were able to provide in the 1920s and '30s," he says.

But by the 1950s and '60s, universities in

the United States had improved a lot, and that led to the rise of a different kind of corporate research lab, what Suh and Shvadron call an "absorptive" lab – one that absorbs the knowledge produced in universities, and builds on it, rather than creating its own.

The main reason for firms to invest in science of any kind is to create products that boost profits, so the question is, why do they publish their research at all? And, if governments or society want them to publish more, what incentives might help? "Whether to publish new knowledge is always a tough strategic decision for a company," says Katrin Hussinger, an economist at the University of Luxembourg. "They have to consider what they could potentially win or lose." Some fruits of internal research are such important company secrets that they will never be published – Google's search algorithm, for instance, or the recipe for Coca-Cola – but other discoveries might serve a strategic purpose if they are shared, says Hussinger.

Sometimes firms will decide to give up their exclusive knowledge of a technology as a way to shape the market, influence regulation and build standards, she says. Automaker Toyota shared the technology behind its hydrogen fuel cells, not out of altruism, but because it wanted to accelerate the adoption of the technology and make its version the industry standard, says Hussinger. Tesla did something similar by opening up its electric-vehicle charging network to other companies. "That can be a win, because the whole ecosystem grows" around a product, says Hussinger, which potentially increases customer demand.

In some industries, such as pharmaceuticals, publishing the results of clinical trials is a regulatory requirement, says David Wehrheim, who studies business strategy at the University of Navarra in Spain. Doctors use these findings to decide which treatments to prescribe. Research papers can also be a marketing device to communicate with markets, investors and customers. This not only signals what the company is working on, but also shows that the work has been certified by others through peer review.

Getting research published in a big-name journal “is better than any marketing” message, says Daniele Rotolo, who studies corporate science at the University of Sussex in Brighton, UK. “It’s a more credible source.”

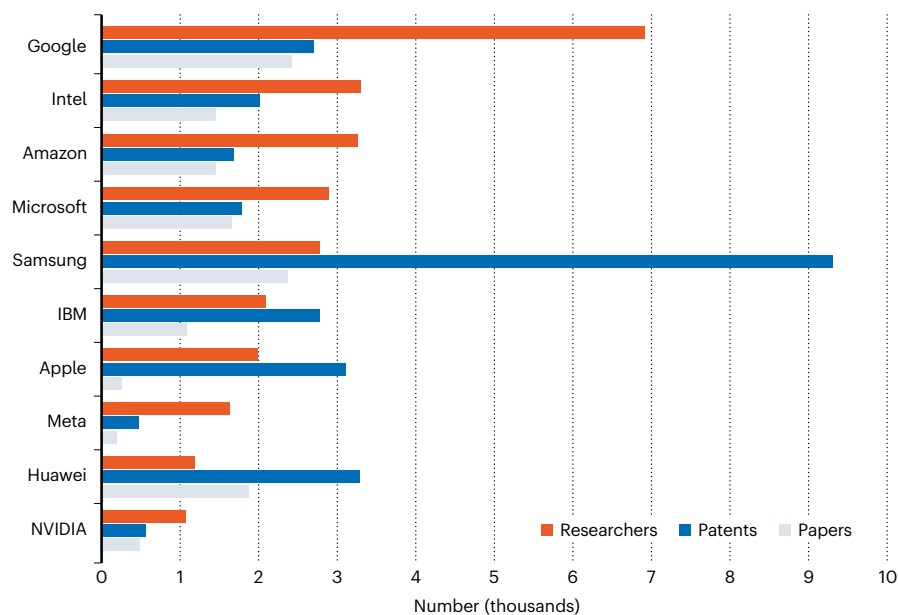
Research publications can also support a company’s intellectual-property (IP) strategy, even if protecting IP might seem like a good reason for keeping results secret, says Rotolo. Companies often try to protect their patents on inventions by pursuing related patenting claims, he says, to prevent competitors from attempting to claim their own patents on incremental changes or improvements. But that can be an expensive strategy. It’s much cheaper to make their additional research publicly available through publications. This allows them to demonstrate that they have changed the state of the art — a term used in IP circles to mean everything about a technology that has been made public — and makes it much more difficult for competitors to claim incremental patents because they can’t show novelty.

A similar strategy can be at play when competitors are racing to claim a patent, says Rotolo. A firm in the lead might publish some of its results to discourage the laggards by showing how close they are to winning. Or those falling behind might publish their research to make it more difficult for the leader to receive a patent or to reduce its expected value. A company might even decide to completely disclose a particular technology (essentially renouncing its claim on a patent) to stop others from patenting it, while preserving its ability to exploit that technology in the future. “A classic example of this is pharmaceutical company, Merck, disclosing all their human gene sequences”, which has been seen as a way to avoid the privatization of that knowledge, so that the company could still use the information later for drug development, says Rotolo. Publishing can also give companies a competitive edge: access to new ideas and recruits from academia, says Scott Stern, an economist at the Massachusetts Institute of Technology in Cambridge. “They spill a little knowledge to get access to more. It’s the ticket of admission to a scientific community they can draw from.”

The ability to publish their work is often an incentive for prospective employees. Stern’s work has shown that scientists are even willing to accept a lower salary for jobs that offer the freedom to publish and set their own research agenda. Looking at roles being advertised in the life sciences, Stern found that jobs that allowed more publishing had starting salaries that were on average 20% lower than more restrictive positions, a trend that has also been seen in other fields. “The ongoing competition for talent plays a role,” says Hussinger. Allowing

PAPERS VS PATENTS

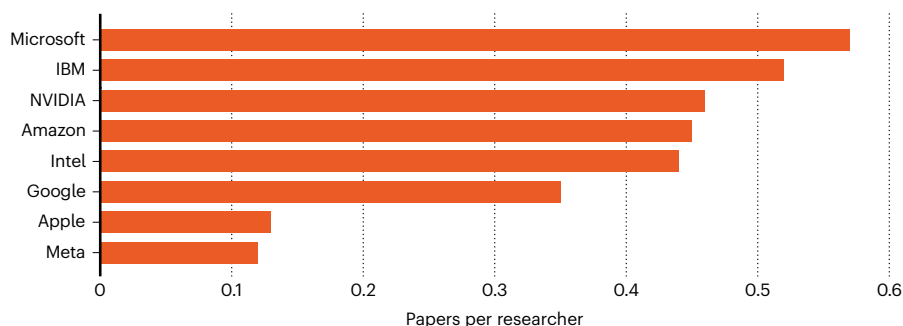
Outputs from 2024 vary widely among the top tech companies by researcher headcount*. Samsung in South Korea — the only non-US company in the list, other than Huawei in China — leads in patents and is second only to Google in papers, according to an analysis of multiple data sets by Sydney-based firm, League of Scholars.



*These figures are estimated to be 60–70% of total fundamental researchers at these companies worldwide and are based on verified Google Scholar accounts affiliated with company e-mail domains.

PAPER PRODUCTIVITY

Among US technology giants, Microsoft published the most papers per researcher* in 2024, according to a League of Scholars analysis based on multiple scholarly indexes. Google has relatively low outputs, given its very high researcher count.



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employees “to publish, go to conferences and build their reputation keeps people motivated”.

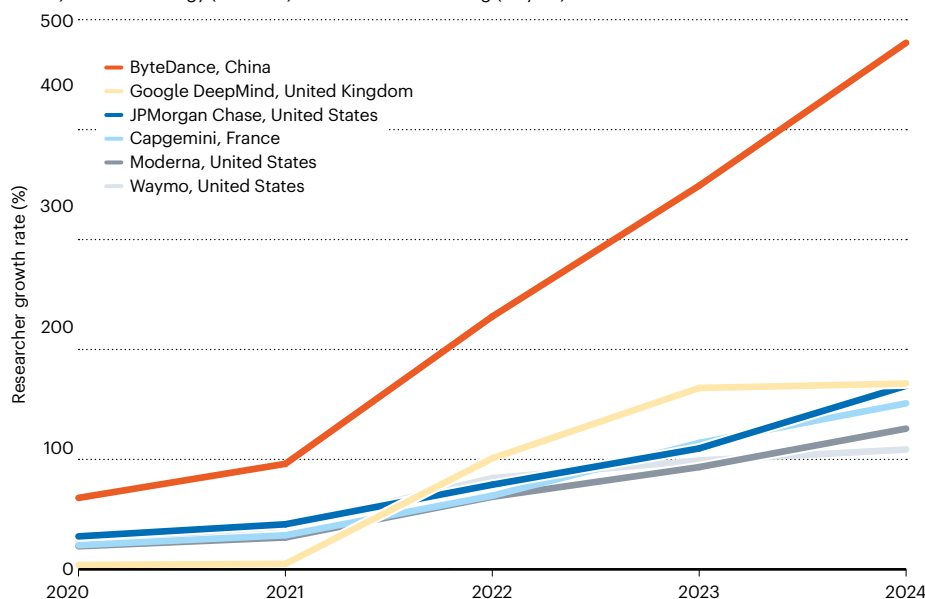
Despite these incentives, publishing by firms seems to be on the decline. US companies are spending less of their R&D budgets on the research side, according to work by Ashish Arora, who studies innovation at Duke University in Durham, North Carolina. The share of fundamental and applied research in corporate R&D declined from 28% in 1985 to 20% in 2015. Less of that research is being published, as well. Since the 1980s, publicly traded companies have spent more on science and research, but the rate of patenting remains relatively stable, and the number of scientific

publications they produce is falling.

The proportion of papers with academic and corporate co-authors is also declining. In the Digital Science Dimensions database, the share of all research articles and conference papers that had at least one corporate author fell from 2.8% in 2016 to 2.4% in 2024. For open-access papers, the proportion in 2024 was even lower — just 2%. Even when firms do publish their work, important information might be held back. When *Nature* published a 2024 paper describing the latest version of the protein-structure-prediction algorithm AlphaFold, it did not include the algorithm’s full underlying code (J. Abramson *et al. Nature* **630**, 493–500;

RESEARCH ROCKETSHIPS

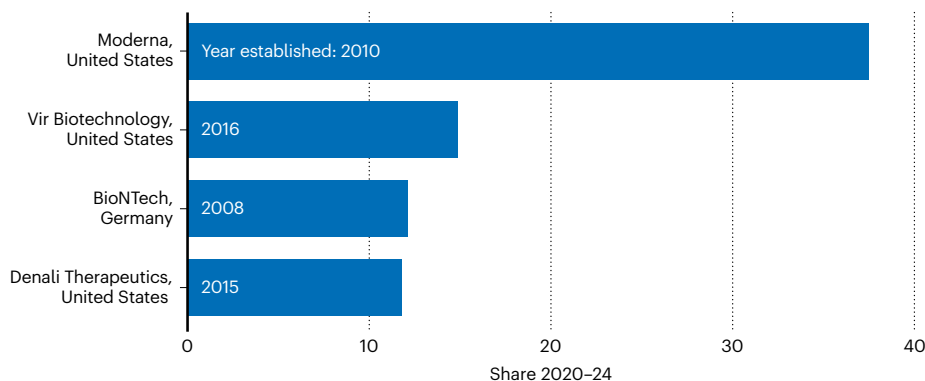
DeepMind, a London AI research lab and subsidiary of Alphabet in California, has rapidly expanded its researcher headcount*, with an annual researcher growth rate of 155% for the period 2020–24. These fast-rising companies are working in a range of industries, from information technology (ByteDance, Capgemini) and banking (JPMorgan Chase) to biotechnology (Moderna) and autonomous driving (Waymo).



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NEW PLAYERS

Of the top 100 corporate institutions in the Nature Index — which tracks output in 145 high-quality health- and natural-sciences journals — these four firms are among the youngest. Moderna, a US pharmaceutical company, is ranked 31st overall, and Vir Biotechnology in San Francisco, California, is in 47th place.



2024). That led to criticisms of both *Nature* and Google DeepMind, the company that developed the tool, that this would limit verification and reproducibility efforts. Academics were given access to an open-source version of the tool six months later. (Nature Index's news and supplement content is editorially independent of the science editors at *Nature*.)

Increasing the proportion of corporate research that is published requires careful policy interventions, but there are some things that can work well, says Hussinger. In the European Union (EU), every research publication immediately counts towards the state of the art, whereas in the United States, there is a grace period of up

to a year. During this time, companies can still apply for patents on published work, so they have less to lose from a publication. Governments can also make public money available to public–private partnerships between research institutions and companies and stipulate that any work produced is to be made publicly available. The EU's Horizon 2020 research funding programme has done a good job of incentivizing companies to work with academics and other firms across Europe while requiring them to publish the results, Hussinger says. Key to such collaborations is a clearly defined IP protection policy that ensures companies are safeguarded from losing out on their IP, she adds.

One particularly successful collaboration has been the long-standing relationship between Dutch tech company Philips and the Eindhoven University of Technology in the Netherlands. The university was founded by Philips in 1956 to meet its need for a skilled workforce, and the two institutions have had a close relationship ever since, says Silvia Lenaerts, the university's rector. An agreement to work together was formalized in 2012. The collaboration is mainly defined by research 'couples' — one researcher from the university and one from the company — who decide together what they want to work on. Publishing is a big part of every agreement: the company is given 30 days to decide whether the results of any project can be published, but in practice, it seldom decides to keep it secret. "We are almost never not allowed to publish," says Lenaerts. The partnership has produced more than 3,000 publications and 7,800 patents over the past 30 years.

Partnerships like this have led to an increase in collaboration between academics and firms, says Shvadron. Since the 1990s, the number of publications by companies that include academic co-authors has risen from roughly 7% to 60% today, he adds. But many university–company partnerships still include non-disclosure agreements to protect trade secrets, says Suh. "Even if we encourage these collaborations between firms and universities, if we cannot solve the fundamental incentives behind why firms do not disclose more of their research, it might become a red herring," he says.

Shvadron notes that simply increasing the number of scientific publications by firms is not necessarily an important end in itself. The goal should be producing useful science at the lowest cost to society that can be turned into products that improve lives. How much of that is published in science journals is a secondary concern. "I don't know that, from a policy perspective, we want firms to publish," he says.

Rotolo says that whether we want firms to publish more really depends on the purpose of publishing. If it complements academic research in ways that accelerate the development of improved technologies, then it is desirable. But if publications are used defensively to protect IP, then it can actually slow technological development and limit the ability of the wider scientific community to build on discoveries in ways that benefit society. "Disclosure can help others build further on that knowledge, but it can also slow down technological development when there are strong IP rights," he says. "It really depends on the context."

Brian Owens is a freelance writer in New Brunswick, Canada.