World view

By Dashun Wang

AI tools can help universities maximize research impacts

Algorithms could identify scientists who need support with translating their work into real-world applications. Leaders must step up.

From the Internet to CRISPR–Cas9 gene editing, many seeds of progress were planted initially in the ivory tower of academia. Could research be doing even more for society? I argue that it could — if universities used artificial intelligence (AI) tools to maximize the impact of their scientists' outputs.

Each year, millions of grant proposals, preprints and research papers are produced, along with patents, clinical trials and drug approvals. Massive data sets storing details of these outputs can be scoured by AI algorithms to better understand how science and technology progress and to identify gaps and bottlenecks that hinder breakthroughs. Over the past few years, my colleague and close collaborator Ben Jones, my team and I have been working with large US universities to maximize their research impacts. We've already learnt a lot.

For example, during our pilot project at Northwestern University in Evanston, Illinois, we worked with one of its researchers in biology. She has published hundreds of papers and acquired tens of millions of dollars in research funding. By tracing her papers and grants and how her research has been used, we discovered an intriguing fact.

The researcher had never engaged with the university's technology transfer office (TTO), yet her research had been used extensively by private companies worldwide — many of their patents cited her work. My collaborator Alicia Löffler, then head of the TTO, talked to the researcher. It turned out that she was unaware of those market impacts. Within one week of that conversation, the researcher filed her first invention disclosure with the university.

This episode raised several questions. How many scientists are in similar positions? Can researchers with untapped innovation potential be identified? And can the obstacles that hinder technological progress be addressed? To find out, Ben, Alicia and I, and our team, have expanded studies to other universities. Our preliminary work suggests that people in such positions are common.

For one, the researcher is a woman. When we compared how often male and female faculty members patented their work, we found a disparity. Male faculty members typically patented their research two to ten times more often than did their female counterparts, although this rate varied by university and discipline. But when we measured the extent to which the two groups' scientific publications were cited by patents, we found no statistically significant difference. In other words, female scientists' work is just as close to the technological frontier.

> **"The dichotomy of basic versus applied research is becoming inadequate."**

Dashun Wang is a professor at the Kellogg School of Management and McCormick School of Engineering, and the founding director of the Center for Science of Science and Innovation at Northwestern University in Evanston, Illinois. e-mail: dashun.wang@kellogg.northwestern.edu

The author declares competing interests; see go.nature.com/4eargt6

Numerous factors can contribute to this gender gap, such as unequal access to education and mentorship, funding disparities, prevailing norms and stereotypes and structural barriers in patenting and commercialization processes. A better understanding of these challenges would help to broaden the pool of innovators.

Similarly, we see a large difference between tenure-track and tenured faculty members: tenured researchers patent their work at a higher rate. But one doesn't magically become more innovative the moment tenure is granted. The causes of this gap are probably distinct from those of the gender one, and might include promotion incentives and what counts towards tenure. But both discrepancies point to untapped opportunities for innovation.

Thus, data and AI tools can help institutions to identify people and ideas that are overlooked, both in a research institution and globally. But universities must take care. They have many roles and responsibilities — from educating future leaders to advancing fundamental knowledge — that must not be eclipsed by efforts to promote practical applications. Some people might argue that scientists don't need to commercialize their ideas themselves, because industry can pick up the ball. Or there might be unintended consequences. Emphasizing what is useful could come at the expense of curiosity-driven research or result in flocking to what seem to be the hottest and most fruitful ideas today rather than to those that will help the world most in future.

But the role of science is changing. Many of today's issues, from pandemics to climate change, are closely linked with scientific progress. The dichotomy of basic versus applied research is becoming inadequate. For example, advances along the science–society interface, such as discoveries that aid marketable applications (M. Ahmadpoor and B. F. Jones *Science* **357**, 583–587; 2017) or social-science insights that guide policymaking (Y. Yin *et al. Nature Hum. Behav.* **6**, 1344–1350; 2022), are highly impactful, as evidenced by high citation rates. By engaging more with use-inspired research, scientists can produce insights that both advance basic understanding and address societal needs.

Encouraging developments are under way. In 2022, the US National Science Foundation created the Directorate for Technology, Innovation and Partnerships to support use-inspired research and translate discoveries into real-world applications. Its Assessing and Predicting Technology Outcomes programme will fund innovative projects — including our work, which we plan to expand to more than 20 universities — to understand how investments in science and technology can best accelerate progress. Other nations, university leaders and policymakers must seize this opportunity, too. I think of science as 'the little engine that could'. If research and development could be made even 5% more efficient, the returns could be immense.

JOSH MILLER