

## METRICS

# China declared largest source of research articles

Report also finds United States is still a science powerhouse despite increasing competition.

BY JEFF TOLLEFSON

For the first time, China has overtaken the United States in terms of the total number of science publications, according to statistics compiled by the US National Science Foundation (NSF).

The agency's report, released on 18 January, details the United States' increasing competition from China and other developing countries that are raising their investments in science and technology. But the report suggests that the United States remains a scientific powerhouse, pumping out high-profile research, attracting international students and translating science into valuable intellectual property.

"The US continues to be the global leader in science and technology, but the world is changing," says Maria Zuber, a geophysicist at the Massachusetts Institute of Technology in Cambridge. As other nations increase their output, the United States' relative share of global science activity is declining, says Zuber, who chairs the National Science Board, which oversees the NSF and produced the report. "We can't be asleep at the wheel."

The change (see 'Shifting landscape') is already in terms of the volume of publications: China published more than 426,000 studies in 2016, or 18.6% of the total documented in the NSF analysis of Elsevier's Scopus database. That compares with nearly 409,000 by the United States. India surpassed Japan, and the rest of the developing world continued its upward trend.

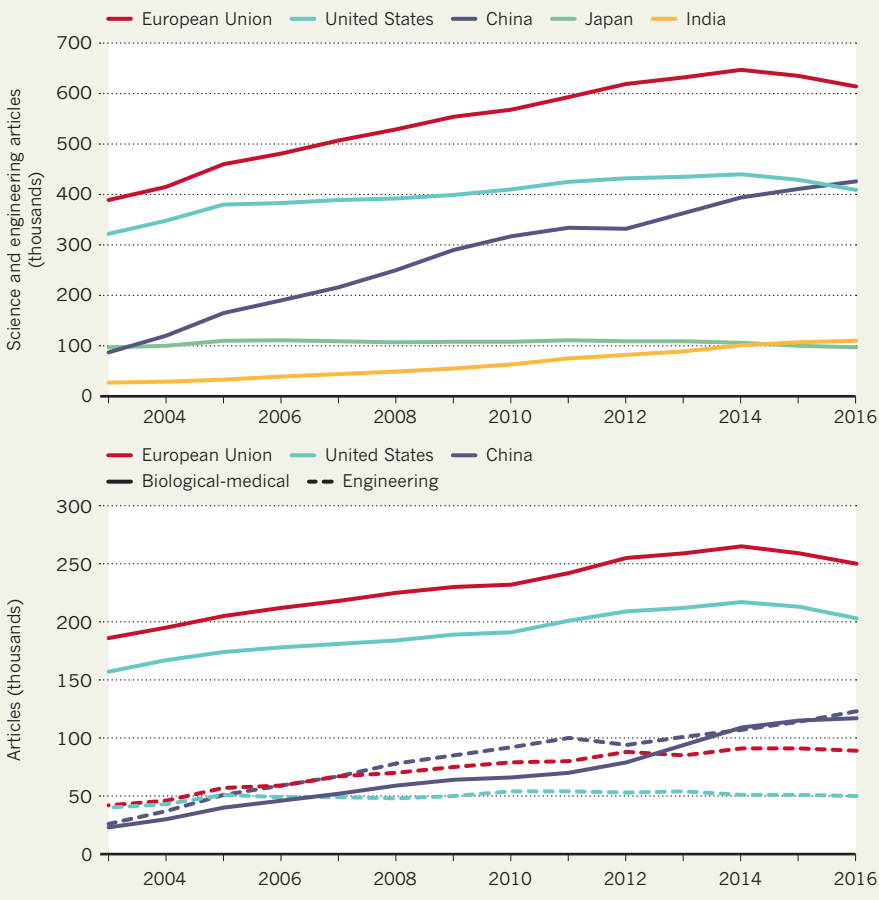
The NSF analysis divides the credit for a publication fractionally among its authors. By contrast, Scopus gives one full credit to each author; as a result, it still ranks the United States first in terms of the number of publications.

The United States ranked third, behind Sweden and Switzerland, when the NSF team examined where the most highly cited publications came from. The European Union came in fourth and China fifth. The United States still produces the most doctoral graduates in science and technology, and remains the primary destination for international students seeking advanced degrees — although its share of such students fell from 25% in 2000 to 19% in 2014, the report says.

The United States spent the most on research and development (R&D) — around US\$500 billion in 2015, or 26% of the global

## SHIFTING LANDSCAPE

China now produces more scientific research articles per year than any other single nation, according to an analysis by the US National Science Foundation. The country outranks the United States in production of engineering articles, but lags behind on publications related to biomedical research.



SOURCE: NSF

total. China came in second, at roughly \$400 billion. But US spending remained flat in terms of its share of the country's economy, whereas China has increased its R&D spending, proportionally, in recent years.

The NSF analysis, the latest edition of the agency's biennial Science and Engineering Indicators, comes at a time of heightened concern about the state of US science. It should raise some alarms, says Mark Muro, a senior fellow with the Brookings Institution, a think tank in Washington DC. Trends in US science spending are heading in the wrong direction, he says, and the talent pool of researchers continues to be limited by under-representation of women

and minorities. Similarly, key industries such as semiconductor manufacturing have been hollowed out as businesses ship production work to other countries, Muro adds.

For the first time, the NSF included a section on technology transfer and innovation in its statistical analysis. Data suggest that the United States continues to lead the world when it comes to measures like patents, revenue from intellectual property and venture-capital funding for innovative technologies. "A nation's innovation capacity is one of the main drivers of productivity growth and so prosperity," Muro says. The new data provide "a useful reminder of why we care about these indicators in the first place". ■