

Excellence in science can't be reduced to just numbers

Last month, Stanford University released a list of the world's top 2% of most-cited scientists. While media coverage in India focused mainly on the number of Indian scientists (52) who made it to the list, the idea of ranking research output remains a controversial one in the scientific community as it often degenerates into a debate over the quality of research and creativity.

To understand these rankings, one must understand what they measure and if they correlate with what is perceived as scientific excellence. The rank assigned to scientists is based on how many other publications cite their work. More citations imply that a particular work was noticed by peers and is a measure of its relevance and possible importance.

American information scientist Eugene Garfield pioneered the system using citations as the basis for ranking scientists when many new scholarly journals began publication after World War II. When journals turned digital in the 1990s, citation data became easily accessible and assigning citations-based ranks gained popularity. One such metric, suggested in 2005 by physicist Jorge Hirsch, is the h-index (Hirsch index), which indicates a scientist's productivity and citation impact. The Stanford rankings are based on a composite index that considers six different indicators, including the h-index.

But are citations a good indicator of the quality of research? The evidence available is not compelling. The Nobel Prize in the

sciences and the Fields Medal in mathematics are widely perceived as representing the highest standards of research excellence. The Stanford-led group examined the citations of 47 Nobel Laureates (2011-2015). Of them, only 15 would get the top rank if the criteria is the total number of citations; 18, if the h-index is used, and 37 if the composite index is used.

Since the citation volume and practices vary widely across fields, any mechanism that uses citations alone can be misleading. For instance, none of the Nobel Prize laureates in 2022 or Fields Medal winners could secure a rank of less than 1,000. Though a Fields Medallist entered the list at 1,023, many other winners did not even figure on the list. Moreover, the top 500 ranks were primarily occupied by biomedical scientists, an understandable skew from complete reliance on citation metrics. If this well-meaning attempt at quantifying research is fraught with such pitfalls, then we must be careful not to interpret the ranks to necessarily imply scientific excellence.

This exercise has also unwittingly brought to light other sordid issues, such as scientists artificially inflating citations or riding on excessive self-citations to game the system. The Stanford data tried to mitigate this problem by giving another ranking chart, disregarding self-citations. These fixes help somewhat in acting against unethical practices but cannot curb the inappropriate use of citation-based metrics.

Since 2005, many universities and funding agencies worldwide have been accused



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of using the h-index and journal impact factors to evaluate applicants for academic positions or research grants instead of a critical evaluation by experts. In 2012, a group of journal editors and publishers initiated the San Francisco Declaration of Research Assessment, calling upon the community "to eliminate the use of journal-based metrics... in funding, appointment, and promotion considerations" and emphasised the "need to assess research on its own merits rather than on the basis of the journal in which the research is published". In 2014, India's department of science and technology supported this declaration: Quantitative assessment of research outputs cannot solely measure scientific creativity. It is, at best, one of the many facets that contribute to a

researcher's profile. If statistical indicators are the only criteria for excellence, then Sachin Tendulkar, with a test batting average of 53.78 and ranked 23 in the list of highest career batting average in Test matches, would not be celebrated as one of the greatest cricketers ever.

In science, as in sports, excellence cannot be reduced to just numbers. The Stanford group's ranking list will be meaningful if it is read, keeping in mind the warning given by its authors: "All citation metrics have limitations and their use should be tempered and judicious".

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The views expressed are personal



MS Santhanam

opposed the new mustard seed.

At present, India is chronically short of oilseeds. It has to import more than half of the oil it consumes, which costs it more than ₹1.5 lakh crore. The oil from seeds grown here yields 40% less than from the genetically modified seed grown elsewhere. Our mustard seed seems to be stuck at its present yield.

There has been much debate recently about India's position on the latest Global Hunger index: 107th of the 121 countries assessed, considerably worse than Bangladesh and Pakistan, though the government has contested the methodology. Opponents of genetic modification can cry themselves hoarse that India is still short of food, of which cooking oil is an essential part. I am not suggesting that allowing genetically modified seeds would solve all of India's agricultural problems and fill the gap in the domestic food supply chain. Agriculture here faces many other problems. The farm-

farmers depended on animals for their locomotive power. Now, these animals have been largely replaced by tractors. Bullocks used to trudge around in a small circle with rotating Persian wheels to pull up water for irrigation. They have been replaced by electric pumps. Mobile phones, digitalisation, and better roads are all impacting farming practices. The success of genetically modified cotton, the only transgenic crop the government has allowed so far, shows farmers' capability and willingness to take to the new mustard seed, though improvement in a number of other input conditions is also partially responsible.

If the mustard tests continue and the Swadeshi Jagran Manch, along with the other opponents of genetically modified crops, are ignored by the PM, he will find he has contributed to fulfilling his ambition of creating an *Atmanirbhar Bharat*.

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{ SUNDAY LETTERS }

A strange paradox

This refers to Karan Thapar's *What India can learn from British politics* (October 30). It is ironical that while the UK's Conservative Party has a large number of non-White leaders, India's equivalent of that party — the BJP — has no representatives from the country's largest minority community. Will Rishi Sunak's rise spark a change?

Maria V, via email

We must fight the climate crisis together

This refers to Gopalkrishna Gandhi's *Crafting an ethical mode of governance for India* (October 30). The article shows that for India@100 to continue to thrive, the concerns that need to be addressed are not only local but global. India should try and unite all countries to fight the threat of the climate crisis.

Rashi T, via email

ASHAs must get more recognition and pay

This refers to Lalita Panicker's *Focus on women's mental health, now* (October 30). ASHA workers are indeed a pillar of India's primary health care network. But it is a travesty that they are not even recognised as regular workers. They deserve better from the government.

Jairaj G, via email

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