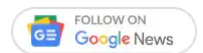


[News](#) / [Opinion](#) / [India can be a world leader in science](#)

India can be a world leader in science

By [K VijayRaghavan](#), [Varun Aggarwal](#)

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India has the scale of the economy, industry size, start-up ecosystem, market, and resources to be one of the top three in the world

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At the India Science Festival (ISF) in Hyderabad earlier this year, we asked an audacious question: What should be the goal of Indian science? One of our co-panellists, Thomas Barlow, a global innovation expert, set the stage for this discussion when he remarked: "This century is for India to take. Its ambition should be nothing less."



Our research needs to focus on India and the world (Shutterstock)

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This statement is not rhetorical. If one looks at the history of the emergence of disruptive science models across the world — Germany’s research and technical universities, America’s university network and its links with industry, space and defence establishments, and more recently, China’s ascendance in Artificial Intelligence (AI), chemistry and life sciences, the time for India to act is now. While we can learn from these leaders, India must develop a unique model to forge ahead. This is possible because today, we have the scale of the economy, industry size, start-up ecosystem, market spread, and resources to invest in science and technology (S&T;). Yet, India’s S&T; strategy lacks

Later that day, we asked a Chinese science expert what we could learn from their model. “Who says Chinese science is doing well — how many Nobel laureates do we have? How many world-changing inventions and discoveries have we done? There is so much more to do,” he said. This anecdote shows our contrasting scale of ambitions. When introspection, ambition and action are intertwined, we can see the result. With only the first, we become a talking shop.

We think India must aim to become a top global three S&T; leader. The question is how to achieve his. Should our research focus on open-ended research or mission-driven translational research, basic or applied areas, on Indian problems or global ones?

We feel basic and applied research are administrative silos that must be broken. In *Cycles of Inventions and Discovery*, Venkatesh Narayanamurti, ex-dean of the Harvard School of Engineering and Applied Sciences, showed that the interplay of basic and applied research leads to innovation. For example, DNA sequencing today is thousand times faster and more reliable than two decades ago. This is because of “simple” chemistry invented by Shankar Balasubramanian and David Klenerman while working in a university department, standing on the shoulders of intellectual giants and technologies such as microfluidics, laser and computing.

A basic vs applied choice is ill-posed. Instead, we prefer the distinction of open-ended and translational research, which has some overlap with those two terms used here, but with more nuance and connection to reality. Open-ended research happens in universities, where scientists think about solving science problems — CRISPR, the gene-editing technique, deep learning, and AI are the results of this.

Translational research is anchored by industry or government and partners with universities. The Covid-19 vaccine and the Mars mission are examples. India needs to invest in both. Translational research is low-hanging — its benefit now and here. On the other hand, open-ended research capacity is indispensable for India’s mid- and long-term leadership. We can’t get there without both. [OPEN APP](#)

Let us make two arguments for this dual investment, addressing oft-repeated criticisms around these. First, India cannot spend the money needed for a critical mass of open-ended research. While we agree that India’s research spending has to go up dramatically, we can make huge improvements by spending efficiently. Today, the lion’s share of government research spending goes to government labs, with universities getting only 10%-15%. In contrast, the university share of government research funding is much higher in the United States (63%), the United Kingdom (80%) and South Korea (50%).

A recent *Ease of Doing Science Report* developed by FAST India found that scientists in top Indian institutions find it hard to raise and spend funds due to bureaucratic hurdles. Fixing resource

the defence R&D budget be spent on research at universities and industry rather than at Defence

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working in a specific area to translate quickly and effectively.

For example, disruption in deep learning happened in 2012 in the western university system. But even after being an IT powerhouse, we have taken almost 10 years to start participating in the global AI economy because we did not (and do not) have a critical mass of AI researchers here. We will have the same experience in quantum computing, neuroscience, space and genetics. If India doesn't build open-ended research capability, we will be distant followers, not leaders.

Regarding the question of India versus global problems, we see this problem in the context of translational research, which is a low-hanging benefit for India. Our research needs to focus on both problems of India, such as cleaning the Ganga, and the world, such as creating highly efficient engines which will enhance our high-tech exports. We need to spur many more of these in different industry and public utility verticals to take research benefits to our people and address the development challenges that the nation faces.

And India's time is now.

K VijayRaghavan, is chairman, advisory Board, FAST and former principal scientific adviser. Varun Aggarwal is co-founder, FAST, IndiaThe views expressed are personal

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