

Indian promise

History and cultural depth are assets that benefit Indian science. But do they also hinder it?

Few countries on Earth can rival India when it comes to size, history or culture. Over thousands of years, it has been witness to great civilizations, invasions, empires, the birth of religions and countless cataclysms. Time and time again, however, India has proved itself to be, in the words of its first prime minister, Jawaharlal Nehru, “a bundle of contradictions held together by strong but invisible threads.”

In its own way, this description is also an accurate portrayal of modern Indian science. The country has a proud heritage and continues to excel in, for example, areas such as mathematics and theoretical physics. Since gaining independence in the mid-twentieth century, it has also become a nuclear power and developed a thriving space research programme. And more recently, an internationally successful knowledge economy spanning aeronautics, IT and biotechnology has sprung up around the southern city of Bengaluru.

Although the Indian research base is strong, it also faces a number of well-known challenges.

However, although the Indian research base is strong, it also faces a number of well-known challenges. India's public university system is, by and large, considered to be bigger on quantity than it is on quality and, but for a few notable exceptions, neglectful of research. The country's notorious bureaucracy and a creaking infrastructure are also drags. Perhaps most importantly, investment in research is lagging — currently India spends 0.9% of its GDP in research, compared to 2% in China and 2.7% in the US. It is therefore not surprising that the brightest and most ambitious Indian scientists tend to go abroad to further their careers.

Prime Minister Narendra Modi appears keen to confront these challenges. In a recent speech at the Indian Science Congress, he proclaimed that India should aim to be one of the world's top three countries in science and technology by 2030. But is such an ambition realistic? And if so, how can it be achieved?

Clearly, a successful research programme depends on a successful economy. For



The Tata Institute of Fundamental Research in Mumbai, India.

example, China's huge investments in science come off the back of an average GDP growth rate of 9.8% between 1980 and 2014. India's GDP growth, on the other hand, has averaged 6.2% over the same period. This is hardly a poor performance, but the cumulative effect is still pronounced: per capita, the two countries had comparable GDPs in 1980, but by 2015 China's per capita GDP was nearly five times India's. So there is some catching up to do.

When comparing it to China, it is customary to carp platitudes about democracy being a luxury that slows India down. This largely misses the point: first, because China's economic emergence has been exceptional by any historical standard, and second, because there are indications its growth rate is slowing down due to structural changes in its economy, just as India's is picking up again. However, when it comes to investment in research itself, there's no denying that China's pragmatic approach — exemplified by a willingness to ruthlessly scale up spending in areas of promise, even at the expense of others — may have some advantages over India's more incremental, hodge-podge approach.

Another aspect India can improve on is linking up its education and research systems. A significant portion of India's research activity is carried out in elite national research centres such as the Tata Institute of Fundamental Research

(pictured) and the Indian Institutes of Technology. Most of these only hire postgraduates following stringent entry examinations. However, with the very best graduates often choosing to continue their studies abroad, and millions of young Indians still shut out from access to a suitable education that puts them in a position to even apply for these positions, the current pipeline of young Indian scientists is quite narrow, even if demography is in India's favour.

Moreover, for a country of its size, there is surely scope for more top-level institutions in India. In this regard, the recent establishment of elite private universities such as Ashoka University in Delhi and Shiv Nadar University in Dadri, Uttar Pradesh is an intriguing development. Historically at least, Indian academics have been sceptical of private higher education, but should this take off as a means to deliver academic excellence, it may lead to a cultural shift in attitude, while also underscoring the importance of preserving the academic independence and autonomy of centres of learning.

Be that as it may, India's strong academic culture is clearly a huge asset overall. Indian scientists belong to a great academic tradition. They are integrated in the world stage. And they are driven by an ambition to build a scientific legacy. Given the right kind of institutional support, there is every reason to be optimistic that they will succeed. □