Yes, Indian science does need a revamp, but how should we go about it?

*Gautam I. Menon**

How should we introduce large-scale changes in the structure of Indian science funding and administration? An example of a similar exercise in a different country may be useful.

Recent articles in the press[1] highlight the recommendations of a report currently being prepared by the heads of all the scientific departments under the Indian Government. These departments include those of Atomic Energy, Space, Earth Sciences, Science and Technology as well as Biotechnology. According to *The Hindu* article[1], what is proposed is '... an over-arching science and technology body that marries research and industry, and will report directly to the Prime Minister'. The article mentions that the report contains '... a broad map on how India ought to prepare itself to be among the top three countries in science and technology by 2030 and ensure that 10% of the top 100 leaders in scientific fields are Indians.'[1]

The example of a report with similar aims, prepared for a related purpose, but in a different country, may be relevant. My example comes from Canada, where the 'Advisory Panel on Federal Support for Fundamental Science' submitted a document titled 'Investing in Canada's future: strengthening the foundations of Canadian research' to the Canadian Minister of Science on 10 April 2017 (ref. 2). This report is colloquially referred to as the Naylor report, after the name of the chair of the panel, David Naylor.

A 280-page document in all, containing around a 100 pages of appendices, the Canadian report was commissioned by the Minister. The panel was provided a mandate that '... entailed a review of the federal system of supports for extramural research … to cover the full range of disciplines involving peer-reviewed science or inquiry, with either a basic or applied orientation'[2]. The panel examined the 'four pillar agencies that support the Canadian extramural research ecosystem: the three granting councils – the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC) – as well as the federal infrastructure agency, the Canada Foundation for Innovation (CFI)'[2]. When combined, these agencies would largely overlap with those funding science and technology in India.

The panel chaired by Naylor had nine members. The panel included an entrepreneur with an exceptional track record of supporting pure research, a Canadian Nobel laureate and a US-based, although Canadian-born, scientist and administrator. Others were academics, each with considerable experience in managing largely university-based research, although none of them was a full-time science administrator. Naylor is a professor of medicine at the University of Toronto, Canada.

The panel was given a year to prepare its report and its mandate was publicized in advance. During this period, the panel called for written submissions from individuals, associations and organizations, receiving around 1275 of them. It also convened roundtables in five cities, where about 200 researchers at different career stages met with the members of the panel[3].

Like the new agency proposed in the Indian report, the Canadian report recommends legislation to create an independent 'National Advisory Council on Research and Innovation (NACRI)', designed to work closely with Canada's Chief Science Advisor. The Naylor report places highest priority for new spending on investigator-led research operating grants, but also stresses the need for 'enhanced personnel supports for researchers and trainees at different career stages', for 'targeted spending on infrastructure-related operating costs for small equipment and Big Science facilities' and for 'enhancement of the environment for science and scholarship by improved coverage of the institutional costs of research'[2]. The panel recommended the restoration of the proportion of funding split between fundamental and priority-driven research towards a 70 : 30 ratio[3].

Of the many interesting parts of the panel report, I cannot resist quoting the following extended passage[2]: 'It is no wonder, then, that prominent U.S. economist Ben Bernanke has lamented that "the declining emphasis on basic research is somewhat concerning because fundamental research is ultimately the source of most innovation, albeit often with long lags"… A temptation to move funds towards applied research, especially during economically challenging times, arises in part out of the uncertainty stemming from the "long lags" to which Bernanke alludes. Such lags occur not only because of the immense complexity of the innovation and commercialization process, but also because major breakthroughs in basic research are frequently the result of serendipitous discoveries that are not foreseeable at the outset. Indeed, setting targets for the social or economic impacts of basic research reflects a profound misunderstanding of its contribution. If the results could reasonably be known in advance, the activity is not really research. Simply put, neglecting basic research owing to impatience or uncertainty contradicts much of the historical evidence.'

There are a number of features of the Naylor report, and of how the deliberations that led up to it were structured, that would be good practice anywhere. The group that produced it combined scientists, university administrators who were practising scientists or social scientists, and an entrepreneur with a specific interest in pure and applied research. These were individuals not directly connected to the government enterprise and in a better position to critically evaluate its flaws. The process by which roundtables were held in multiple cities and the way public input was synthesized into the final document ensured that all

*The views expressed are those of the author.

voices could be heard. The rationale behind the specific recommendations made in the report was detailed carefully and supported by an extensive analysis contained in the appendices to the main report. Finally, the report itself is exceptionally well-written and a pleasure to read, despite its length and the specialized nature of its content.

Returning to the Indian document, it mentions that 'The stature of Indian science is a shadow of what it used to be… because of decades of misguided interventions. We have lost self-confidence and ambition and the ability to recognise excellence … we often chose the mediocre at every level'[1]. An approach that assumes the inability to recognize excellence might reasonably do better through simply asking for more broad-based input and taking it seriously. While lamenting that 'We have lost self-confidence and ambition and the ability to recognise excellence amongst our own'[1], the manner in which the report appears to have been formulated so far reinforce precisely those tropes.

The Indian report itself seems to be a work in progress, rather than a completed document. One can thus hope that these and related issues will be addressed before it achieves its final form.

1. http://www.thehindu.com/sci-tech/science/indian-science-needs-a-revamp-says-report/article18028668.ece (accessed on 18 April 2017).
2. http://www.sciencereview.ca/eic/site/059.nsf/vwapj/ScienceReview_April2017.pdf/$file/ScienceReview_April2017.pdf (accessed on 18 April 2017).
3. http://www.universityaffairs.ca/news/news-article/naylor-report-lays-groundwork-re-new-basic-research-canada/ (accessed on 18 April 2017).

Gautam I. Menon is a member of the Theoretical Physics and Computational Biology Groups, Institute of Mathematical Sciences, Chennai 600 113, India.
e-mail: menon@imsc.res.in

COMMENTARY

Science, profit and innovation

Sumit Bhaduri

'A country without science is like a car without an engine: it's not going anywhere', mentioned an editorial in *Nature*[1]. To scientists this may sound obvious, but in today's world rational thinking matters less than ideology and prejudice. A significant part of the global population has little trust in the elite, and scientists as a social group are perceived thus[2]. One reason for this may be the silence of the scientific community on the political economy of a world view that has brought the world to its present state. Contrary to the title of a much hyped book of the early 1990s, the disintegration of the former Soviet Union, did not result in the end of history[3]. Nor did aggressive 'state capitalism' in China play a part. Rather, financial globalization and the myth of an all-knowing market economy got a huge fillip.

For more than 20 years private capital, legitimate and illegitimate, moved across national boundaries with unprecedented ease. Companies made profit by cutting down on labour costs and taking advantage of the loop holes of country-specific tax laws. This led to an overall loss of jobs, a many-fold increase in corruption, and heightened economic inequality the world over. The excesses of fictitious finance capital and the shadow banking industries finally climaxed in the spectacular market failure of 2008 (ref. 4). Its full economic and political impacts are yet to unfold fully, but science and technology (S&T), both globally and in India, have not been immune to these profound changes.

The agenda and the interests that drive much of current S&T originate from an incomplete understanding, deliberate or otherwise, between 'profit' and 'innovation'. Profit today means a safe and assured return on invested private capital. Innovation, on the other hand, is an economic abstraction that tries to contextualize the role of technology in the evolution of a capitalist society[5]. It basically means new ways of doing things that improve the quality of life, but not by breaking laws or inflicting hidden damages[6]. New ways of doing things that improve the quality of life require investment and involve the risk of failure. Profits generated by successful innovations are rewards sanctioned by society to the entrepreneurs and other stakeholders for their risk-taking abilities and successful efforts in lifting the economy to a higher level.

The market crash of 2008 was a rude wake-up call for the world as many of the 'innovative products' of the financial world turned out to be fictitious. Several banks and companies that were household names came under the scrutiny of the regulators after the market crash. The banks that were 'too big to fail' had to be rescued by massive state intervention with tax-payers' money. It also turned out that, to maximize profit, an astonishingly large number of reputed companies that boast of research and development (R&D)-driven innovations had manipulated, fabricated and suppressed scientific data and evidences.

Pharmaceutical giants such as Pfizer, GlaxoSmithKline, Johnson and Johnson, Merck, Abbott and Amgen collectively paid about 11 billion dollars in fines in the US courts. They were accused of 'the intent to defraud or mislead' the consumers. Novartis, the self-proclaimed champion of innovation, was fined 390 million dollars for granting kickbacks to pharmacies that recommended the company's drugs in the US. In India, Novartis had gone to the Supreme Court to defend an ever-greening patent and lost. They had failed to present any evidence of a difference in the therapeutic efficacy between gleevec, a minor modification of a molecule that they wanted to patent again, and the raw form of imatinib, the original molecule patented years ago.