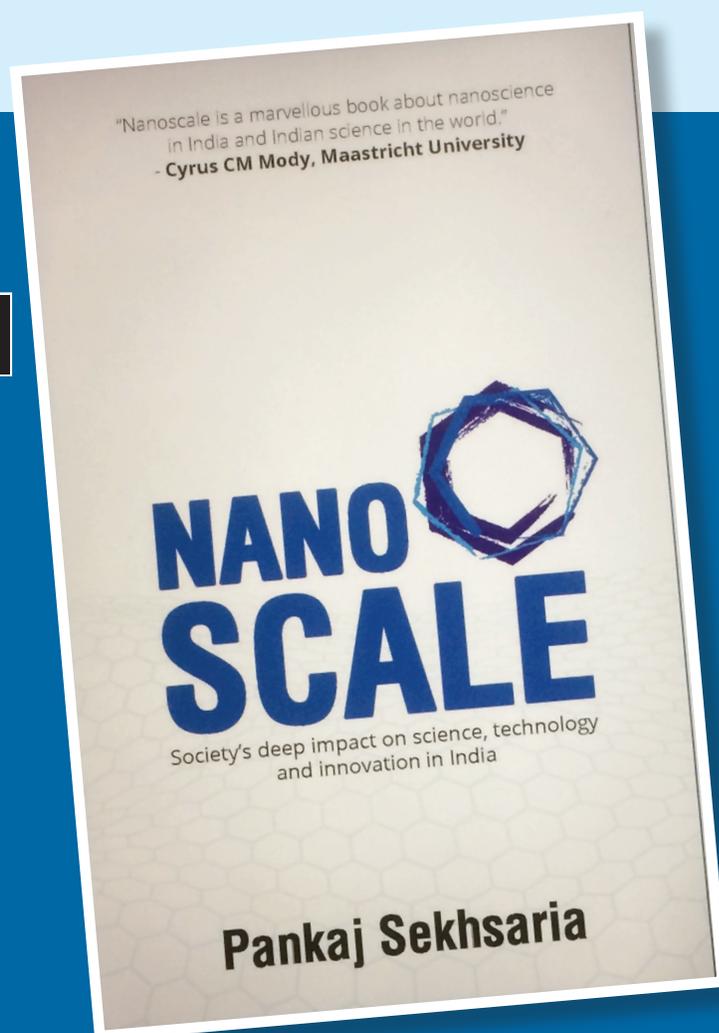


Exploring Socio-cultural Aspects of Nanotech in India

Dinesh C. Sharma



NANOTECHNOLOGY is one of the few fields of scientific research that gets highlighted in popular news media. Most of the news stories are about 'exciting' developments related to the potential application of nanoscience and technology in medicine, agriculture, environment, energy, food and so on. Many are about how wonderful nanoparticles can be in treating some of the hard-to-treat diseases like cancers and making available drugs more potent. Such stories often catch people's attention, though the developments discussed may still be far off from becoming usable products or solutions. Indian scientists and research laboratories are on the forefront in this sector, given the policy and funding impetus nanotechnology has received in the country in the past two decades.

All this makes nanotechnology a much-celebrated subject in media and among policymakers. *Nanoscale* is not about this celebration but provides deep insights into social, cultural, geographical and other factors that play a role in

Title

Nanoscale — Society's deep impact on science, technology and innovation in India

Author: **Pankaj Sekhsaria**

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shaping nanotechnology development in India. It gets under the skin of laboratories and scientists to give readers a raw view of 'doing science'. It is refreshing to read about the process of scientific research and technology development at the bench level and through the voices of people behind those benches. While macro-picture of nanotechnology in India in terms of funding, publications, patents, etc. is well mapped, the book is an attempt to explore what it calls 'micro-realities' and day-to-day challenges of what happens inside laboratories engaged in research and innovation.

The book is an outcome of doctoral research work of the author Pankaj Sekhsaria, involving years of fieldwork in laboratories in Pune, Hyderabad and Chennai. The work at these labs was located in 'broad and well-acknowledged markers of contemporary Indian society'. These are economic and material constraints (a university lab developing cutting-edge microscopes despite severe resource constraints); traditional practices and knowledge systems (where modern nanotechnology is attempting a conversation with ancient Ayurveda); drinking water as a fundamental exigency (lab using nanosilver in a ceramic candle water filter to make clean water affordable to the poor); and the disadvantaged girl child (a team of clinician-scientists developing nanotech-based treatment protocol for retinoblastoma).

The author subjected the work and processes at four laboratories to a framework known as social construction of technological systems or SCOT. Sekhsaria found 'convincing evidence that what happens outside significantly influences what happens inside' even in labs whose research is remote from immediate needs and concerns of the society. He says 'it is not enough to innovate inside the laboratory – culture and society need to be simultaneously engaged with and innovated if desired outcomes are to be achieved'. This is indeed an important finding.

While discussing the case studies, Sekhsaria dwells upon certain conceptual questions that arise. For example, the fabrication of scanning tunnelling microscope (STM) at the Dharmadhikari laboratory in the Department of Physics, University of Pune throws up important questions about what has been termed 'technological jugaad'. Since 1988, when Dr C.V. Dharmadhikari built the first indigenous STM, this work has gone through a long journey. A number of constraints had to be overcome due to the unavailability of parts as well as resources. Old and used things like a refrigerator, bobbins used in sewing machines, stepper motors from junked computers, tubes from car tyres, etc. were used to fabricate prototype of 'state-of-the-art' STM. The author calls this 'technological jugaad' though he says he wanted to avoid the term jugaad altogether but there was no escaping it.

'Technological jugaad,' he says, is characterised by eight elements – reconfiguring materiality; problem-solving; driven by resource constraints; bridging systems and ways of knowing; liminality; not (intended) for commercialisation;

an activity of the commons; culture of recycling. Several of these elements like recycling, resource constraint and reconfiguring materiality are also elements of 'frugal innovation' as defined by innovation guru Anil Gupta. He frowns upon the very term jugaad which has come to be associated with make-shift or patchy solutions such as *Maruta* in many states in North India. Such jugaad is inherently dangerous to users as well as the environment.

The kind of work done in the Dharmadhikari lab is frugal innovation – making best use of available resources and materials – and not jugaad though Dharmadhikari himself uses the term in interviews with Sekhsaria. Unfortunately, jugaad has been placed on a high pedestal by western and Indian management experts as well as lay media. Some of them have gone to the extent of calling India's Mars Orbiter Mission (MOM) as jugaad simply because it achieved cost-effectiveness by innovating a trajectory that optimised fuel use. It was frugal technological innovation and not jugaad. Sekhsaria should have dwelt upon this distinction, rather than falling unwittingly in the trap of jugaad.

Another interesting case study in the book is about nanotech-based water purifier developed at the Hyderabad-based International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI). Researchers developed a nanosilver ceramic candle for use in candle-based water purifiers. Candle impregnated with nanosilver particles not only filters water but also acts as an anti-bacterial device. Unlike other filtration systems that need electricity or pressurised water supply, the candle-based filters are affordable and nanotechnology gave it an additional advantage. The technology was transferred to an entrepreneur and he started marketing it in Hyderabad and elsewhere. But the response of shopkeepers as well as consumers was cold, and the product did so badly that the factory had to be shut.

Apparently, scientists did not take into account something that would have been obvious to a marketing person – user perception. Though the product deployed the latest technology – silver nanoparticles – it was perceived as obsolete because the technology was used in candle-based filters which were considered outdated in comparison to other technologies like RO and UV. The case shows why scientists need to interact with users and learn from the market while working on new products.

Overall, *Nanoscale* is an interesting book presenting insights into the working of Indian laboratories – public, private, university-based – and the process of dealing with a new area of technology with great promise of wide applications. It is a much-needed addition to the emerging field of science and technology studies (STS) in India and hopefully will inspire others to take up such serious work.

Mr Dinesh C. Sharma is a science journalist and Jawaharlal Nehru Fellow for 2020-2021. Email: dineshsharma@gmail.com