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From *Machino*facture to *Man*ufacture: Changing contours of the science and technology discourse in the 1970s and 1980s in India

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From *Machino*facture to *Man*ufacture: Changing contours of the science and technology discourse in the 1970s and 1980s in India*[1]

Radhika Krishnan

In October 1980, several intellectuals, scientists, economists, and political activists gathered in the idyllic hill station of Coonoor in Tamil Nadu to share what they termed as "common concern at the accelerating pace of retreat from reason". The result of their deliberations was a document released by the Nehru Centre in Bombay in July 1981 under a somewhat bland and innocuous title "A Statement on Scientific Temper". This "statement" (referred to as SST in future) was a reiteration of a commitment to scientific rationality and the need for optimizing the results of science and technology:

> ... the scientific temper ... is the most precious heritage of humanity. It is the result of incessant human labour, search and struggle ... the fullest use of the method of science in everyday life and in every aspect of human endeavour from ethics to politics and economics … is essential for ensuring human survival and progress … one should accept knowledge gained through the application of the method of science as the closest approximation to truth at that time, and question what is incompatible with such knowledge … the inculcation of Scientific Temper in our society would

* Lecture delivered at the Nehru Memorial Museum and Library, New Delhi, 12 August 2014.

[1] This formulation of a shift from '*machino*facture' to '*man*ufacture' was coined by the scientist Amulya Reddy, as an articulation of the need to shift the existing focus of science and technology.

> result in our people becoming rational and objective, thereby generating a climate favouring an egalitarian, democratic, secular and universalist outlook.[2]

In keeping with its deep faith in the "scientific method" (as the term goes), the SST thus saw an espousal of this method as the "closest approximation to truth", and effectively the only road worth exploring in the journey towards human survival and progress. Writing the foreword to the document, P.N. Haksar (former Principal Secretary to the Prime Minister and Deputy Chairman of the Planning Commission) expressed a hope that the statement would generate a wider debate and discussion, leading to a "much needed second renaissance" in India. The SST might not have ushered in a "second renaissance" or a retreat of obscurantism and irrationalism as the authors fondly hoped for; it did however succeed in evoking passionate responses. For almost a year, arguments and counter-arguments continued over the SST. Scathing and furious criticisms of the SST came from several individuals and organizations which had strikingly different ideological and political predilections. This debate will be discussed later, along with other related ones that took place in the 1970s and 1980s. Suffice to say at this point, the discussion over the SST was an indication that the "ameliorative" nature of science and technology, and its easy equation with "development" was hardly a *fait accompli* during this period.

In the 1950s and the 1960s, Nehru had perhaps best articulated the new nation's hopes from the world of science and technology: Nehru believed that "recourse to science and its application" was needed to remove many of the "anomalies that exist in Indian society".[3] For him, science and technology had

[2] Amit Bhaduri et al., 'A Statement on Scientific Temper', *Mainstream,* 25 July (1981), 6–10.

[3] Jawaharlal Nehru, 'Inaugural Address at the 47th Session of the Indian Science Congress held at Bombay, 3 January 1960', in Baldev Singh (ed.), *Jawaharlal Nehru on Science: Speeches Delivered at the Annual Session of the Indian Science Congress* (New Delhi: Nehru Memorial Museum and Library, 1986), 73–74.

changed the world "for the better", and would continue to do so.[4] His main concern, as he articulated to the delegates of the 46th session of the Indian Science Congress held in 1959, was that India had "not quite caught up to these wonderful discoveries of science".[5] The Nehruvian vision therefore held that it was an "accepted tenet" for one to "pay obeisance to" and "worship at the temple of science".[6] Paradoxically perhaps, science and its "rationality" were occasionally invoked with religious fervour by its proponents.

This discourse around science and its application was however complicated by the myriad voices of dissent and resistance that emerged slowly but surely in the 1970s and 1980s. T.K. Oommen points out that after independence, several movements were kept in "suspended animation". He adds, however, that from the mid-1970s, the centrality of the Indian state "came in for interrogation", and post emergency, the state lost legitimacy as the "prime mover of economic development". Further, he says, by the 1980s, the very idea of "state-sponsored, capital intensive, high-technology driven model of modernization came to be questioned".[7] Possibly, during this period existing contradictions came to the fore and became increasingly difficult to ignore or underplay. If in the period immediately following independence, promises and hopes were offered, the late 1960s onwards saw growing expressions of doubts and disillusionment.

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[4] Jawaharlal Nehru, 'Inaugural Address at the 46th Session of the Indian Science Congress held at Delhi, 21 January 1959', in Baldev Singh (ed.), *Jawaharlal Nehru on Science: Speeches Delivered at the Annual Session of the Indian Science Congress* (New Delhi: Nehru Memorial Museum and Library, 1986), 69.

[5] Ibid., 71.

[6] Jawaharlal Nehru, 'Inaugural Address at the 49th Session of the Indian Science Congress held at Cuttack, 3 January 1962', in Baldev Singh (ed.), *Jawaharlal Nehru on Science: Speeches Delivered at the Annual Session of the Indian Science Congress* (New Delhi: Nehru Memorial Museum and Library, 1986), 75.

[7] T.K. Oommen, 'Introduction', in Oommen (ed.), *Social Movements I: Issues of Identity* (New Delhi: Oxford University Press, 2010), 35–37.

This doubt and disillusionment played out as multiple voices of dissent expressed by peasants, workers, farmers, and *adivasi*s. Overtly or covertly, the multiple voices of dissent and contestation acknowledged concerns over the nature of technological regimes unleashed in independent India, and on the impacts of the capital and energy intensive economic model being followed. Interestingly, for instance, the Bihar Pradesh Kisan Sabha (BPKS), while formulating its demands, strategies, and programmes during its first Congress held in Patna in March 1984, committed itself to a struggle for "changing the big bourgeois industrial policy, for the establishment of agro-based small and medium-sized industries and for bringing industrial development in harmony with the development of agriculture", even as it demanded proper compensation for displacement due to development and industrial projects (note, moreover, that its agenda mentions that the compensation should not merely be a monetary one).[8] One thus sees in this articulation an expressed desire for an alternative industrial model—the opposition to industrial policy is understood not only in terms of demands for more employment or against displacement. It is similarly useful to recall that the very growth of *kulak* movements and a powerful middle peasantry demanding lower input and higher output prices in the agricultural sector has been traced to the Green Revolution and its contradictions.[9] The workers' movement too occasionally acknowledged the impact of technology, as is evident from the textile workers' strike in Bombay and the fisherpeople's movements in Goa and Kerala.

This period also saw the emergence of "environment" as a concern, inasmuch as issues of ecological balance, use and misuse of resources, and resource alienation can be classified as

[8] 'Programme of the Bihar Pradesh Kisan Sabha', *Reports from the Flaming Fields of Bihar* (Calcutta: CPI(ML), 1986), A3–5.

[9] For instance, the Rudolphs have asserted that the growth of what they call the 'bullock capitalists'—small to medium sized self-employed independent agricultural producers operating between 2.5–14.5 acres of land—is the result of the Green Revolution. See L.I. Rudolph and S.H. Rudolph, *In Pursuit of Lakshmi: The Political Economy of the Indian State* (Chicago: University of Chicago Press, 1987).

"environmental" concerns. The emerging "environmental" movement—with its varied strands— provided a tenuous meeting ground where multiple voices could come together, even if briefly, to share their concerns over the "development" discourse. On the one hand, if workers, peasants, adivasis, and farmers were expressing their opposition to the "development" presented to them and in the process discovering commonalities and differences, concepts of "science", "technology", and their applicability were being reworked and debated possibly in response to these voices of dissent. The discourse on science was surely seeing a shift, with even some of its practitioners and proponents seeking to reinvent and redirect its focus.

Towards Reinventing the Role of Science and Technology

In the 1960s, policy and planning was focussed on heavy industrialization; in the official parlance, "development" was often simply equated with industrialization, using primarily non-renewable fossil fuel resources. Science was, in turn, a force meant to redeem us from our "backwardness". One can find an indication of this in the coverage of the academic journal, *Seminar*. The March 1964 edition of *Seminar* was on "Scientific Attitude"; on "irrational beliefs of our people and how to change them".[10] In 1966, the June edition focussed on "utilization of science and technology" and expressed a hope that developing countries "would ... follow the path taken by Japan, which has in recent years outstripped, in some fields of technology, the more advanced countries by a careful direction of its relations in science and technology with advanced countries".[11] The focus, as Nehru put it, was to "catch up" with the "more developed", scientifically advanced countries.[12]

[10] S. Dhawan, A. Rahman, and P.M. Bhargava, 'The Problem', *Seminar No. 55*, March 1964, 10–11.

[11] S. Hussain Zaheer, 'The Problem', *Seminar No. 82*, June 1966, 12.

[12] Jawaharlal Nehru, 'Inaugural Address at the 46th Session of the Indian Science Congress held at Delhi, 21 January 1959', in Baldev Singh (ed.), *Jawaharlal Nehru on Science: Speeches Delivered at the Annual Session of the Indian Science Congress* (New Delhi: Nehru Memorial Museum and Library, 1986), 71.

However, we can locate a clear shift in priorities in the coming decades—if in the 1960s, the focus was on "changing the outlook" of the people, on creating a scientific temper, this was clearly not enough by the late 1970s and in the 1980s. In 1979, R.K. Laxman drew this cartoon (see Annexure 1) which appeared in *Science Today*, featuring two astronomers peering through a telescope and talking to each other: "a piece of Skylab ... that is one of the Cosmos series ... and over there Bhaskara. You say you can't identify the object in the centre—that's a star, Professor!"[13] It was a comment, perhaps, on the scientific establishment's obsession for grand designs and human-made "wonders". Moreover, it was a reflection on the occasionally bewildering absence of focus on the basic requirements of a scientific discipline—an astronomer is thus seen to be oblivious to the presence of a star as he blithely gloats over man-made satellites. The star is forgotten for the satellite, just as the use of science to meet the basic needs of human beings was often eclipsed and neglected. At around the same time, two more cartoons by Laxman appeared in *Science Today*. One caricatured the concept of recycling: a man tells a friend, "Oh, we started recycling garbage long ago. I dump the heap next door; he dumps it at the door next to him. And so on, till it makes its way back here" (see Annexure 2). In another (see Annexure 3), two scientists are heard talking to each other: "Your invention, the cigarette lighter of the future, is fine. But, where will they get the fuel for it?"[14] An indication, perhaps, that "new" concepts—scarcity and conservation—were being acknowledged in the world of science and in society.

By the end of the 1970s, we thus find references in the *Seminar* to the explosion of the myth of "perpetual progress" and "end of scarcity", and also to the inequities which technology had given rise to.[15] In an article written in 1979, Rajni Kothari traced the roots of the environmental crisis to the change in man's reliance on nature to man's dependence on machinery—a crucial

[13] R.K. Laxman, 'The World of Science', *Science Today*, October 1979, 15.
[14] Ibid.
[15] Rajni Kothari, 'The Larger Question', *Seminar No. 237*, May 1979, 35.

change which he claimed was responsible for the growing demands of resources and energy and for rendering man "marginal", "superfluous", and even "obsolescent". For Kothari, "man-in-technology" had created a "massive system of dominance, exploitation, inequity and repression", while also destroying nature and organic bonds with other species.[16]

In an article titled "Can We Salvage Indian Science?" G.N. Ramachandran, then professor of Mathematical Biology at the Indian Institute of Science (IISc), bemoaned the fact that scientific research "has not produced much good"; that scientists "do not appreciate the purposeful role of science and have converted their aims and ambitions to something far removed from the needs of society".[17] The establishment however, was essentially tracing its "failure" in terms of inadequate training, infrastructure, or lack of "innovation". The *Seminar* issue of February 1981 asked: "What has gone wrong? What are our scientists actually capable of? How innovative are our industries? Are our institutions of higher learning doing what they set out to do? Why do we need foreign aid for appropriate technology? Have our scientists failed us? Or have we failed them?"[18] It was left, therefore, to some scattered voices, however marginalized in the establishment, to push the discourse in new directions. In the process, new terms and new ideologies of technology made an entry in the development discourse: recycling, renewables, local self-reliance, "alternative", "appropriate" technologies and the like.

In the early 1970s, we thus find efforts to open a space for a debate on the choice of "correct" technologies, the role of "appropriate" technologies and the need to "change the model", so to say. With the realization that "every pattern of technology is socially conditioned", Amulya Reddy argued in 1972 that western technology patterns lend themselves to inequality,

[16] Ibid., 36.
[17] G.N. Ramachandran, 'Can We Salvage Indian Science?', *Science Today*, October 1979, 10–12.
[18] 'The Problem', *Seminar No. 258*, February 1981, 11.

alienation, and environmental damage.[19] In other words, they were "genetically coded" to produce the consequences they ended up engendering. On a similar note, critiquing a document prepared by the National Committee on Science and Technology (NCST) titled "An Approach to the Science and Technology Plan", K.R. Bhattacharya castigated the NCST's concept of science for being "fallacious" and "unscientific", for leading to an "elitist" and "perhaps self-serving" and "illusionary" science plan for the country.[20] Bhattacharya, who was then the general secretary of the C.S.I.R. Scientific Workers' Association, argued that the emphasis should be "on village rather than on city, on people rather than experts".[21] He further advocated that "intermediate technology" should be the "basic pillar" of our approach—with priority to dispersed, small-scale, low-capital, labour intensive industries.[22] "The 'growth' model of development is nothing but a model for development of *underdevelopment* and a continuation of colonialism through the backdoor," he added.[23]

Reddy echoed these views—arguing also for technologies which could use the skills of traditional craftsmen like potters, weavers, tanners, and oil millers.[24] Reddy also advocated technologies that use local materials and local sources of energy; that are not energy-intensive; that "promote a symbiotic and mutually reinforcing rather than parasitic and destructive, dependence of metropolitan industry upon rural population".[25] As Reddy put it, the core of approach should be inequality reduction

[19] See Amulya Reddy, 'The Nature of Western Technology: Why Does it Inevitably Produce Alienation, Unemployment and Environmental Damage', in Ravi Rajan (ed.), *Amulya Reddy: Citizen Scientist* (New Delhi: Orient Blackswan, 2009), 59–66. This article was originally published in 1972.
[20] K.R. Bhattacharya, 'Changing the Model', *Seminar No. 169*, September 1973, 16.
[21] Ibid., 17.
[22] Ibid., 17, 20.
[23] Ibid., 20.
[24] A.K.N. Reddy, 'Alternative Technologies', *Seminar No. 169*, September 1973, 28.
[25] Ibid., 28–29.

and meeting minimum needs, and this could be done by moving from '*machino*facture' to '*man*ufacture'. The discourse, therefore, was sought to be shifted to self-reliance and "appropriateness" of technology.

Asking fundamental questions on the role of science and scientists in society, Dunu Roy argued for a new understanding of science as a "*method of understanding*".[26] Delivering the Vikram Sarabhai Memorial Lecture in 1981, Dr. Anil Sadgopal identified five main obstacles for the scientific establishment to ponder upon: information gap, the tendency to follow traditions, fatalism, fear of reprisals by vested interests, and the inability for abstraction.[27] In the same lecture, Sadgopal flagged other important issues: how the scientific establishment chose to ignore and underplay clear scientific evidence of drug-resistance (ultimately leading to the failure of the malaria eradication programme), how some technologies which increase the gap between the rich and the poor were deliberately chosen for implementation, and how scientists conspicuously avoid discussing the question of distribution of resources. He was, in a sense, pointing out that behind the purported "value-free" and "neutral" nature of science, there operated a dynamics defined by politics and power.

In this rethinking and reshaping that was taking place within and without the scientific establishment, scientists were being told to reject the idea that they had solutions to all possible problems; that all "unmediated" needs had to be addressed by science and technology.[28] Some voices of dissent, though admittedly muted, demanded "de-learning", "relearning", and even "de-professionalization". The urgent need to "subordinate"

[26] Dunu Roy, 'A Search for the Meaning of Science', *Science Today*, October 1979, 33–36.

[27] Anil Sadgopal, 'Beyond Question and Clarity', *Science Today*, October 1981, 29. Originally presented as the Vikram Sarabhai Memorial Lecture delivered at New Delhi on 12 August 1981.

[28] P.R.K. Rao et al., 'Science and Technology as an Ideology', *Seminar No. 269*, January 1982, 66.

science and technology to the real needs of society and to curb the "illegitimate" power of those in control of technology, was underlined and flagged off. Moreover, the scientist was told to drop his/her obsession with the laboratory and make a beeline to the village, and forge partnerships with the villager in order to develop "useful" technologies. This shift found a reflection in the setting up of "alternative" departments in the best institutions of science and technology in the country—including the Indian Institutes of Technology and the Indian Institute of Science. In 1974, ASTRA (Application of Science and Technology for Rural Areas) was established in IISc, Bangalore (present day Bengaluru), and in 1978–79, a new centre called Rural Development and Technology (RDAT) was set up in IIT Delhi. ASTRA's original vision statement reads:

> ... a valid development strategy should be based, not wholly on the technologies of the advanced countries, but on alternative technologies that facilitate low capital investment, employment generation in rural areas, dispersal of mini-production units to villages ... despite the vital need of developing these alternative technologies, it is unfortunate that the challenge has not been taken up by more than a few institutions ... alternative technologies cannot be ... confused with primitive technologies. In fact ... they may require sophisticated scientific and engineering thinking ... Institutions have been engaged in a desperate quest for relevance, but this relevance has been almost universally interpreted to mean relevance to large-scale industry and urban problems. The possibility of relevance to rural problems has been scarcely considered ... it is amidst this background that the Indian Institute of Science has created ASTRA.[29]

As the vision statement reveals, the scientific community was trying, albeit in a small way, to overcome its urban bias, to become more "relevant", and more conversant with rural reality.

[29] Quoted in Amulya Reddy, 'Problems in the Generation and Diffusion of Appropriate Technologies', in Ravi Rajan (ed.), *Amulya Reddy: Citizen Scientist* (New Delhi: Orient Blackswan, 2009), 156–157.

"Transfer of technology" now no longer automatically meant a transfer from the "developed" West to India; it could also mean an exchange of ideas between Indian scientific institutions with its engineers and laboratories and the village on the other hand. And, the engineer/scientist was also told that he/she was simultaneously learning from the villager. In early 1989, the *Lokayan Bulletin* published 28 "lessons" learnt by ASTRA from working in rural Karnataka—this article debunked the idea that rural people were "irrational"; it implored technologists to "first be students" gathering information from people.[30]

It would indeed be a useful exercise to go into some detail at this point into the ideas of Amulya Reddy, who in so many ways influenced this very interesting institute. One of India's most celebrated electrochemists, Reddy was trained in London and returned from a postdoctoral assignment in the University of Pennsylvania, disillusioned with the lack of social concerns, values, and ethics in science. Hankering for academic freedom and socially relevant technology, Reddy helped to set up ASTRA within the IISc in Bangalore—a centre that grew out of the concern that poverty had actually increased with industrialization in India. Reddy had come to believe that an attack on poverty required a different science and technology.[31] He was concerned about the existence of what he termed a "dual society" in India and the lack of adequate "income-generating employment in the rural countryside".[32] For Reddy, technology had to be rooted in concerns of equity, self-reliance, empowerment of the poor, and environmental soundness.[33] Moreover, influenced by the controversy over the Narmada valley projects, Reddy developed a firm belief that benefits of development projects should start with people at the project sites.

[30] Amulya Reddy, 'Lessons from ASTRA's Experience of Technologies for Rural Development', *Lokayan Bulletin*, Vol. 7, No. 1, January–February 1989, 27–36.
[31] Amulya Reddy, quoted in Ravi Rajan (ed.), *Amulya Reddy: Citizen Scientist* (New Delhi: Orient Blackswan, 2009), 9.
[32] Ibid., 10.
[33] Ibid., 13–14.

Between 1981 and 1983, Reddy was involved in a project to set up a community biogas plant in a village near Bangalore. In the process of implementing the project, Reddy realized the need for "democratization of innovation" rather than mere popularization of science.[34] In other words, he was stressing the need for the language of technology to be shaped as well as internalized by its users and implementers. Through experiments at ASTRA and elsewhere, Reddy was to develop an understanding of how the scientific establishment in general and technologists in particular should engage with the villager, the adivasi, and the woman for whom they ostensibly develop technologies. The development of technologies, if they are to be truly "appropriate", required the active and democratic participation of its intended users, felt Reddy. Technology development was essentially seen as a collective process of search, discovery, and innovation—a process where the villager could not remain a mere "irrational", passive (and admiring) receiver of the wonders showered by the "rational" scientist from the city.

Reddy's search for appropriate technologies led him to attempt a "transformation" of sorts of the so-called "traditional" technologies—in his own words, traditional technologies were "suboptimal" and thus inadequate, while the so-called "modern" technologies, "which are often just bad 'Xerox' copies of Western technologies" did not pass muster either. Therefore, for him, the "transformation" of traditional technologies was seen as a very important source of rural development. Appropriate technologies were to reflect local needs, specificities, and cultures; successful technologies could not automatically be transplanted elsewhere and be expected to succeed.

As Reddy wrote and experimented with various technological options in Karnataka, in Pune a civil engineer too perplexed himself with thinking about and designing technologies to suit rural India's needs. K.R. Datye, who had worked with several groups and movements in Maharashtra, including the Shramik

[34] Ibid., 18.

Sanghatana, the Narmada Bachao Andolan, and the Bhoomi Sena, felt the need to bridge the gap between social movements and technology. The Centre for Applied Systems Analysis in Development (CASAD) which he helped to set up, believed that a new technological model, a technological alternative, needed to be visualized and painstakingly put in place—a model which would aid rather than hinder the process of radical social transformation. Datye focussed on two main areas: building a sustainable agricultural model and simultaneously building a diverse, low-energy input model for sustaining local economies.

The idea was essentially to create several dispersed, self-sufficient communities which would meet their basic needs of food, clothing, shelter, and other essentials themselves through local industries. The local economy was to be based on sustainable agricultural practices (such as the use of organic manures, local seeds rather than the so-called high-yielding varieties and on low water inputs) as well as on new low-energy building materials and diverse energy options. These communities were to communicate with each other with the help of efficient communication systems, which in turn would reduce the need for large-scale transportation systems. This vision, presented in a document prepared by Datye and his colleagues, was called "Alternative Technological Horizons".[35]

On the one hand, this technological vision meant the use of completely new materials—fibres and colloidal silica from biomass, for instance—to replace steel and petrochemicals or at least to drastically reduce their need. In other words, this new technological world was to be built and fuelled with new materials created from biomass and other locally available resources like wood, fodder, earth, and stone. On the other hand, it would spawn a completely different kind of economy—decentralized, with far

[35] Quoted from Gail Omvedt, *Reinventing Revolution: New Social Movements and the Socialist Tradition in India* (New York: M.E. Sharpe, Inc., 1993), 248–250.

more local production, consumption, and control. Not just fuels and materials, but technical know-how too would be locally available. Small dams, tanks, ponds, fisheries, poultry farms, buildings, roads, and towers would certainly be a part of this vision; the focus was use of renewable energy systems to fuel decentralized industrialization and skilled rural employment. Moreover, the dominant mode of production was to be commodity production by small farmers and small industries.

Reddy and Datye possibly represent in many ways the churning that was taking place within the world of science—as scientists and engineers struggled to grapple with the complexities of the world around them. Reddy, Datye, Sadgopal, and Dunu Roy, all of them engineers and scientists trained in the so-called premier institutes of science in India, were ending up asking fundamental questions about science, its applicability, its purported neutrality, and moreover about the "appropriateness" of technological regimes unleashed in India. The differences apart, and differences there surely were, what emerges is the burgeoning of an alternative imagination for the world of science, propelled in part by the exigencies of Indian society in the 1970s and 1980s.

But, this churning was surely not confined within the world of scientific institutions—it in fact found expression outside of the rarified corridors of universities and research institutions. In the process of this search for new ways of engagement with science, there was also a search for an "emancipator" model of its practice. Let us have a look at this "Statement of Shared Concern" released in 1982 by several individuals from diverse backgrounds, which sought to comment on the role of science and technology:

> Current development can, in fact, be described as the process by which the rich and the more powerful reallocate the nation's natural resources in their favour and modern technology is the tool that subserves this process ... Our growing capabilities in science and technology have helped us acquire a technological literacy that allows us to converse with the rest of the world as equals … But, science and

technology cannot be allowed to impose their own value system on society.[36]

The 1970s in fact saw the emergence of several groups, arranged under the broad rubric of People's Science Movements (PSMS), specifically highlighting the anxiety that science "was not meeting the needs of our people". The People's Science Movement also took cognizance of what it termed the "total acceptance of the modernization thesis".[37] It identified this uncritical equating of "modern physical structures" with "development" as one of the arenas of its struggle, along with the fight against feudalism in its entirety. Introducing Dunu Roy's article "A Search for the Meaning of Science", *Science Today* wrote, "Science is not for science's sake, it is for the people. Scientists themselves should realize that they are socially accountable ... People's science movements seek to question the direction that science is taking in India, even as they try to provide alternatives."[38]

Set up in 1962, the Kerala Shastra Sahitya Parishad (KSSP) for instance, saw science as a means to "revolution". For probably the first time in India, science was literally taken to the streets. KSSP developed a strong organizational structure during 1967–72, and from the early 1970s took a decisive turn to the countryside, organizing several rural science forums. Similar movements cropped up in other parts of the country—in 1974, Anil Sadgopal left the Tata Institute of Fundamental Research to set up Kishore Bharati in Hoshangabad; the Madras-based Patriotic and People-oriented Science and Technology (PPST) was formed in 1979, the Lok Vigyan Sanghatana (LVS) was set up in Maharashtra in 1980. The first all-India convention of PSMs was

[36] Anil Agarwal et al., 'A Statement of Shared Concern', *State of India's Environment: The First Citizens' Report* (New Delhi: Centre for Science and Environment, 1982), 190.

[37] KSSP, *Science as Social Activism: Reports and Papers on the People's Science Movements in India* (Trivandrum: Kerala Shastra Sahitya Parishad, 1984), ix.

[38] *Science Today*, October 1979, 33.

held in November 1978, followed by the second one in February 1983. As many as twenty organizations across the country participated in the second convention—including the USV, KSSP, LVS, Kishore Bharati, PSSP, the Karnataka-based Rajya Vigyan Parishad, and the Eastern India Science Club Association from Calcutta (present day Kolkata).

The activity reports presented by the various PSM groups at the All India Convention of People's Science Movements held in Trivandrum in 1983 indicated that concerns regarding modern technological regimes were not merely philosophical, but already a part and parcel of struggles. For instance, the Lok Vigyan Sanghatana in Maharashtra reported that it was running campaigns against thermal and nuclear power plants and aimed at promoting solar energy and biogas plants.[39] The Audyogik Jeevan Manch was preparing reports on the increasing work intensification due to technological changes such as automation, concerned as it was with the need to "rehumanize" the working life and ensure more workers' control over the industrial workspace.[40]

There were however ideological as well as tactical and programmatic differences between various groups in the people science movements. Achin Vanaik identifies three distinct trends: firstly, there was a "conservative" trend which confined itself to "providing scientific information" and was not keen on mobilizing themselves.[41] Secondly, there were some groups (like the KSSP and the USV) explicitly placing the people science movement as an integral part of a larger struggle for social change and transformation. These groups often focussed on man–man, as well as man–nature relationships and the linkages between the two. K.P. Parameshwaran, who was a leading KSSP activist, expresses the predilections of this trend: "without 'scienciteracy',

[39] Ibid., 74–75.
[40] Ibid., 107–108.
[41] Achin Vanaik, *The Painful Transition: Bourgeois Democracy in India* (London and New York: Verso, 1990), 189.

democracy becomes meaningless", he stated.[42] Thirdly, we had groups like the PPST who focussed on indigenous knowledge and traditions and tended to reject western intellectual traditions.[43] For Ramachandra Guha, PSMs were essentially "bringing to the fruition the ideals of the French Revolution—democracy, equality, and fraternity". These movements, as Guha points out, were highlighting the "distortions" of science by capitalist and imperialist systems, and in the process were attempting to "free it from those chains of domination".[44] Part of this search for making science "work", so to say, can also be seen in several other initiatives: in 1983, Ashok Khosla set up the "Development Alternatives" in Delhi "to create sustainable livelihoods in large numbers … in harmony with nature"; Vilasrao Salunkhe (a Pune-based bureaucrat) sought to counter the devastation caused by drought in Maharashtra through setting up a community-managed lift irrigation system; Balkrishna Renake experimented on small-plot intensive cultivation.

Contesting "Scientific Temper"

With this visible churning happening as technology and science was being debated and reoriented, it was probably not surprising that this churning found reflection in the heated responses to the "Statement on Scientific Temper" (SST) issued in 1981. Some responses were in broad agreement; S.G. Sardesai, for instance, argued that the scientific temper was an integral part of the struggle against social, economic, and political "reaction"—against neo-colonialists, landlords, and capitalists, as well as against chauvinism, casteism, and communalism.[45] Given that in

[42] Quoted in G. Sivaramakrishnan, 'S&T: Road to Utopia', *Seminar No. 355,* March 1989, 31.

[43] Note, this is the not the only available analysis of trends in the people science movement. See Ibid., 29–33 for a slightly different analysis. Sivaramakrishnan saw groups like ASTRA as part of the people science movement; personifying an 'Appropriate Technology' focused trend.

[44] Ramachandra Guha, 'The Alternative Science Movement: An Interim Assessment', *Lokayan Bulletin*, Vol. 6, No. 3, 1988, 8.

[45] S.G. Sardesai, 'Part of Larger Struggle', *Mainstream*, 29 August 1981, 14.

the 1980s, technology had already come to be questioned, a group of professors from the Jawaharlal Nehru University (JNU) attempted to defend the statement by separating science from technology: "the fact remains that all technology is *not* universally suited, while *all* science is", they sought to point out.[46]

On the other hand, Ashis Nandy ripped apart the SST; claiming that "science today is the main instrument of oppression in the world", Nandy accused the authors of the statement of "holding the sufferers in imperfect societies responsible for their own suffering".[47] He fumed that the SST was "the posthumous child of colonialism", that modern science too was a "myth" and a "major source of superstitions". Elsewhere, Nandy argued that science was now the "reason" of the state, a goal of the state, and not merely a tool used by the state.[48] Nandy held that modern science had been elevated to a pedestal, promoted at the cost of traditional knowledge and culture. Not just this, for him, science was inherently violent and completely incompatible with democratic governance. Claude Alvares agreed with, and added on to this critique: for him, "the more science, the more the violence".[49] Alvares argued that application of modern science and technology is essentially "war", and was exclusivist, hegemonic, and colonizing. Alvares, therefore, was willing to write its obituary, "the permanent eclipse of Galilean science is an idea whose time may have come", he proclaimed.[50]

Vandana Shiva also agreed with this scathing critique. She was not convinced of the rationality of the "scientific method",

[46] Purushottam Agrawal et al., 'Essence of Scientific Temper', *Mainstream*, 29 August 1981, 14.
[47] Ashis Nandy, 'Counter-Statement on Humanistic Temper', *Mainstream*, 10 October 1981, 16–18.
[48] See Ashis Nandy, 'Introduction', in Nandy (ed.), *Science, Hegemony and Violence: A Requiem for Modernity* (New Delhi: Oxford University Press, 1988), 1–23.
[49] Claude Alvares, 'Science, Colonialism and Violence: A Luddite View', in Nandy (ed.), *Science, Hegemony and Violence: A Requiem for Modernity* (New Delhi: Oxford University Press, 1988), 68–69.
[50] Ibid., 111.

and took issue with the claim that science was "beyond space, time and ideology".[51] According to this trained physicist, ecological conflicts essentially articulated technological and scientific conflicts.[52] Labour-intensive technologies were pitted against "foreign" technologies aimed at "modernizing" the production process; traditional knowledge of the "non-expert" which was open to all was forced to compete with codified and "protected" scientific knowledge of the "expert". Shiva moreover saw this conflict as being simultaneously deeply ideological and even epistemological: alien technologies operate on self-defined premises of "productivity" and "efficiency", for instance, and then set about proving their superiority based on those parameters.[53] Pointing to the experience of science and technology, Sunil Sahasrabuddhe too came to a similar conclusion: "Modern science is intrinsically false, the problems and dilemmas being genetically related to this intrinsic falsehood," he claimed.[54]

PPST published a particularly caustic response to the SST, which it called a "repulsive exercise in cynicism and hypocrisy".[55] It saw the SST as an attempt to "ruthlessly put down" India's traditional sciences and technologies, that too at a time when the

[51] Vandana Shiva, 'Myth of the Scientific Method', *Mainstream*, 19 December 1981, 9.

[52] Vandana Shiva, 'Ecology Movements in India', in T.K. Oommen (ed.), *Social Movements Part II*: *Concerns of Equity and Security* (New Delhi: Oxford University Press, 2010), 280.

[53] To bolster her case, Shiva shows how the traditional use value is now being pitted against the exchange value—where utilization (minus the commercial exchange) was once the barometer to measure value, now the new scientific-technological-economic regime identifies value only when commodity exchange takes place in an identifiable commercial space. And it is on the basis of this new definition of value, i.e., commercial exchange and not merely use, that indigenous technologies lose the battle of "productivity".

[54] Sunil Sahasrabuddhe, *Gandhi's Challenge to Modern Science* (Goa: Other India Press, 2002), 11.

[55] 'The Statement on Scientific Temper: The Educators in Need of Education', *PPST Bulletin,* Vol. 2, No. 1, March 1982. *Yagya* is a Sanskrit word referring to a ritual of sacrifice. *Havana* means the sacred offerings made to fire, and *moksha* refers to *nirvana* or release from the cycle of birth and death.

adverse impacts of western technologies were wreaking havoc; it termed western science as a plunderer and destructor of third-world economies and cultures. Moreover, it saw the practice of western science as being characterized by "utter callousness, unscrupulous opportunism, and unquestioning acceptance of all authority". The complete PPST statement is quoted here:

> … What about those other *havana*s and *yagna*s called space exploration, nuclear technology, biotechnology, color television, jumbo-jets etc. For whose *moksha* are these being performed? ... What about the division into the rich and the poor, the powerful and the powerless, the oppressors and the oppressed, the scientific and the unscientific, being brought about in the name of science, technology and development? ... Why are they erecting a new deity called the Scientific Temper and insisting that we surrender ourselves completely to its mercy?

After Nandy's and Shiva's response, several people countered their arguments. Harish Sethi and Dinesh Mohan wrote a detailed rejoinder, specially questioning Nandy's advocacy for "critical traditionalism".[56] Boudhayan Chattopadhyay, while agreeing that scientists should have a humanist-scientific temper, accused Nandy of indulging in "libel" when he laid the blame of Nazism on science rather than on technology.[57] It is also pertinent to note that not all responses and critiques of the SST voiced the same disillusionment with science. Deepak Dhawan, a CPI(M) leader from Punjab, took issue with the fact that the SST had nothing to say on the politics behind the alliance of "industrial and landed oligarchs"—an alliance which he blames for many of India's problems.[58] Rajendra Prasad, who also articulated the CPI(M)'s view, broadly shared Dhawan's opinion though he was far more critical of the SST. Prasad's response, which was published by

[56] Harish Sethi and Dinesh Mohan, 'Time for Reason, Not Tantrums', *Mainstream*, 17 April 1982, 15–18.

[57] Boudhayan Chattopadhyay, 'In Defence of the Scientific Method', *Mainstream*, 14 November 1981, 38.

[58] Deepak Dhawan, 'Scientific Temper: Need for Clarity', *Mainstream*, 19 December 1981, 11.

the *Social Scientist* as well as the *Mainstream*, claimed that the SST "presents a totally ahistorical perspective" and grossly ignored class and social forces as active and influential agents.[59] However, these responses shared a faith in technology, though when in the "right" hands: they argued that "abolition of oppression and inequality, and the urge for modernizing society are feasible social goals *only* when science is allied to the social forces capable of revolutionizing society".[60] The responses to the SST only indicated that the advocates of "modern", "western" science now had to carefully qualify their support in multiple ways. No longer was "Science" the New Deity, nor could it easily feign a distance from technology. If its character, its contradictions, and its linkages to power were being ruthlessly exposed, its "universality" and purported "neutrality" too came under serious scrutiny.

Conclusion

In 1872, Gast painted the 'American Dream': a remarkable oil painting which depicted a woman, "Progress", floating through the air with slender wires of the telegraph in her hand, the railroads, the steamships, and the urban landscape in the background. Commenting on this depiction, art historian Joshua Taylor observes, "It's a grand and majestic progress, and everyone is happy with it except that snarling bear and the wretched Indians in the lower left hand corner".[61] If in the US "that snarling bear and the wretched Indians" did not quite figure in a "Dream" fuelled by technological progress, in India too, it had its dissenters.

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[59] Rajendra Prasad, 'The Debate on Scientific Temper', *Social Scientist,* Vol. 10 No. 1, January 1982, 56–60; Rajendra Prasad, 'A Political Question', *Mainstream*, 17 April 1982, 19.

[60] Ibid., 20.

[61] Quoted from Merritt Roe Smith, 'Technological Determinism in American Culture', in Merritt Roe Smith and Leo Marx (eds), *Does Technology Drive History? The Dilemma of Technological Determinism* (London: The MIT Press, 1994), 11.

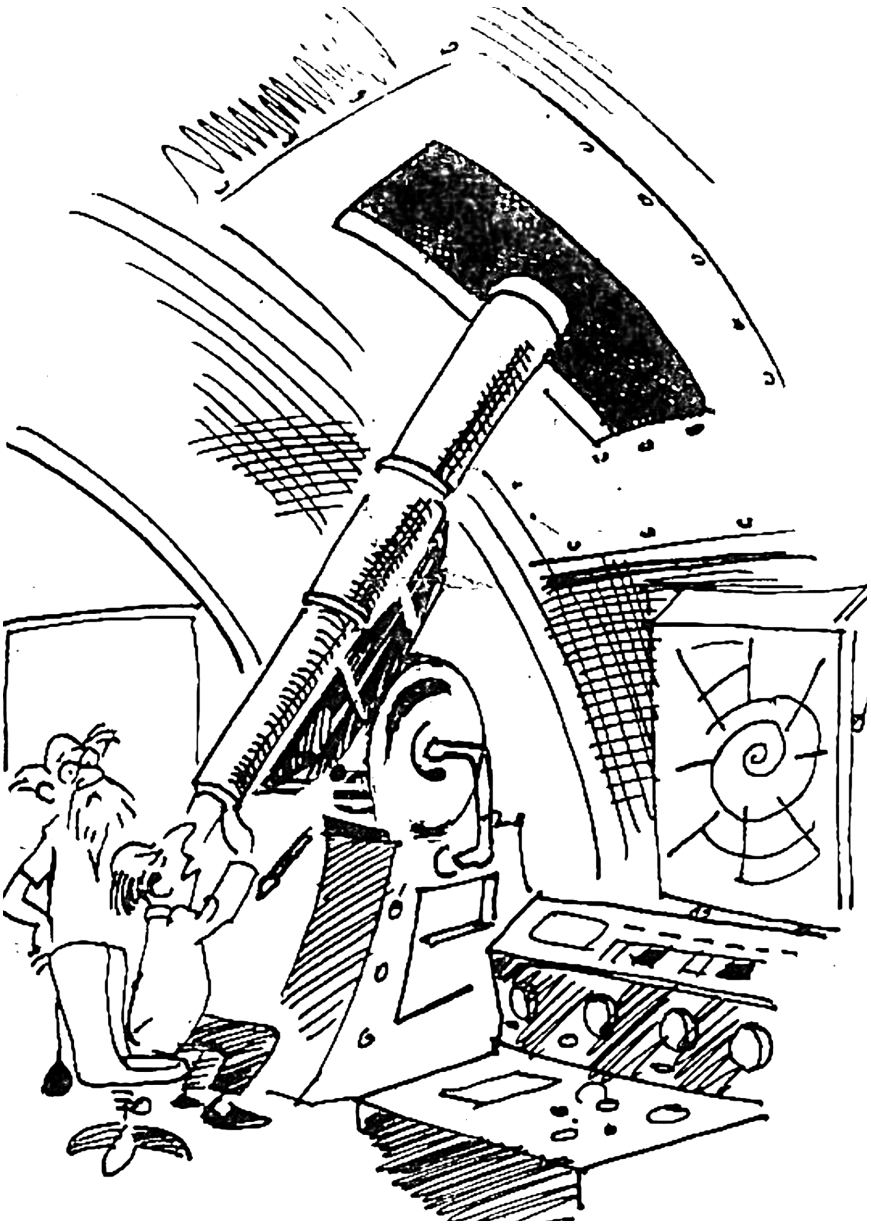
In India, Mohandas Karamchand Gandhi was of course one of the more ardent voices against the received notion of scientific and technological progress and "civilization". The British court system, electricity, the much-touted railways, "modern" (or rather allopathic) medicine—all these symbols of progress and civilization—were met with scepticism. In the decades immediately following independence, the marginalization of the Gandhian alternative has been amply documented by several historians such as Deepak Kumar and Benjamin Zachariah. However, as Zachariah points out, the imprints of these imaginations could clearly be seen in several voices who were attempting to forge a new engagement with technology. At a time when the implications of the Nehruvian capital and energy intensive model were revealing themselves, it was not surprising that this spawned a search for fresh ideas and models. Guha points out that Nehru himself was to cast doubts over the overarching preponderance for size, and over what he termed the "disease of gigantism". Quoting from Nehru's speech titled "Social Aspects of Small and Big Projects", Guha claims that Nehru had shown an appreciation for small industries and small irrigation projects that could change the face of the country.[62]

In the 1970s and 1980s, this attempted reshaping of the existing technological regimes took on various hues. "Appropriate" technologies, revival of traditional knowledge and innovating skills, designing technologies that flow with natural cycles, new sustainable building materials, and energy options—the varied ideas at times contradicted each other, and at times acted as priceless supplements. The differences apart, and the differences are impossible to ignore, what is more useful to note are the commonalities, the shared concerns, and the vision of technological choices made as if people matter—providing space for the concerns of the adivasi or the peasant whose source of livelihood has been snatched away, whose traditional skills have been rendered redundant, the worker who faces the unenviable

[62] Quoted in *http://ramachandraguha.in/archives/prime-ministers-and-big-dams.html* (Website accessed on 12 May 2014).

choice of unemployment and hunger or an increasingly alienating workspace. These ideas, when taken together, forced us to rethink, reframe, and redesign our entire technological and industrial framework. It was, possibly, as Reddy aptly put it, an attempt, however tenuous, to move from *machino*facture to *man*ufacture.

Annexure 1



"... a piece of Skylab ... that is one of the Cosmos series ... and over there Bhaskara. You say you can't identify the object in the centre—that's a star, professor!"

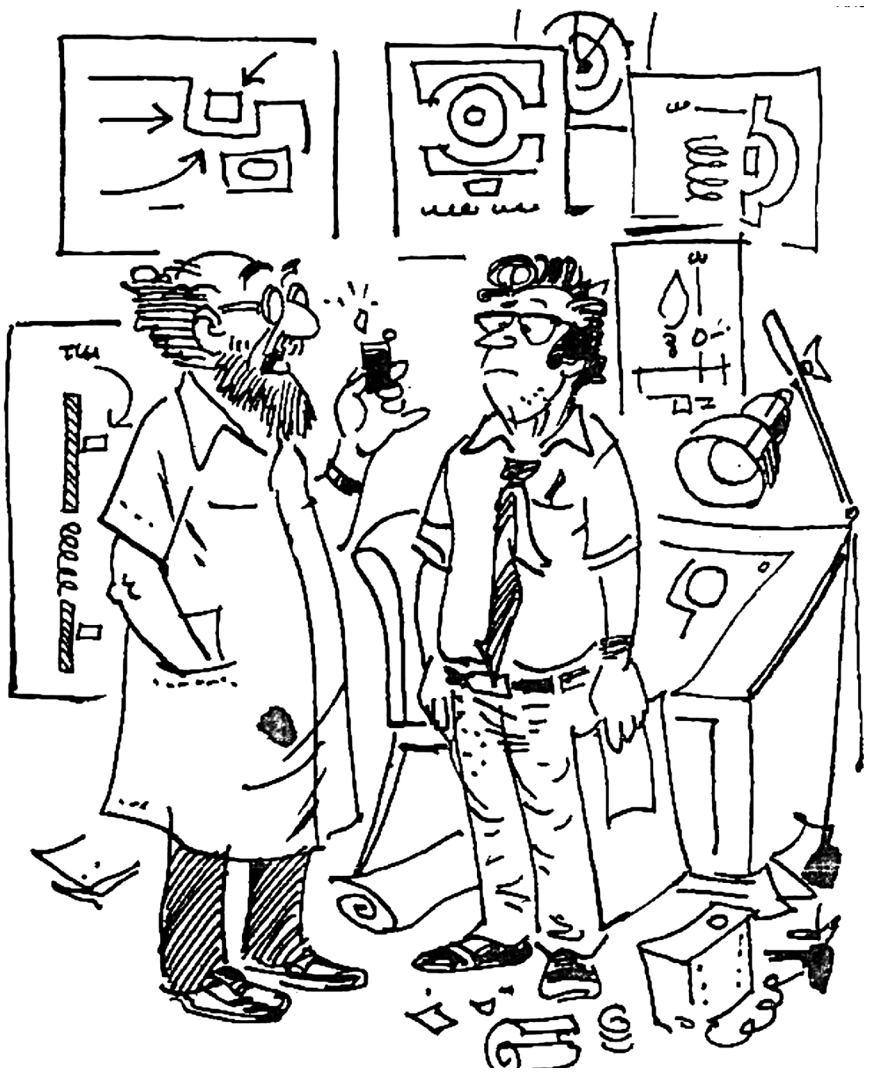
Source: R.K. Laxman, 'The World of Science', *Science Today*, October 1979, 15.

Annexure 2

"Oh, we started recycling garbage long ago. I dump the heap next door, he dumps it at the door next to him. And so on, till it makes it's way back here."

Source: R.K. Laxman, 'The World of Science', *Science Today*, October 1979, 15.

Annexure 3



"Your invention, the cigaratte lighter of the future, is fine. But where will they get the fuel for it?"

Source: R.K. Laxman, 'The World of Science', *Science Today*, October 1979, 15.