

SCIENCE AND TECHNOLOGY IN INDIA

Modern science originated as a response to the dominant and autocratic theological way of life in Europe that brooked no dissent. Its separation from religion and focus on free search for truth distanced it from the day to day life of the common people. The separation between thinking and feeling, analysis and experience led to total lack of concern about the subjects of analysis. Science was rational and objective knowledge that positioned the 'scientist', the subject, at a distance from the object. The knowledge thus generated was to enable man to establish control over nature and make it amenable to the demands of "progress". Such progress was to be achieved in the face of scarcity of and competition for natural resources. Control of women's fertility using modern scientific technologies to minimize the competition became a goal. Perceived as objects whose reproductive capacities were to be controlled to suit the requirements of modernization, the approach was of establishing control of women's procreative abilities without an assessment of the associated risks to women's bodies. Further women's bodies (distinct from abilities), except for their reproductive systems, were understood to be no different from men's. Such a restrictive understanding of women's difference from men was accompanied by invisibility of women's biological specificity and uniqueness in studies on medicine and health. Male bodies were the reference for all scientific and medical research other than on reproduction. These powerful global institutional processes have driven women's bodies out of their control and engendered invisibility and abuse by Science & Technology innovation. The corporatisation of S&T in the contemporary knowledge society has accentuated this directionality.

SCIENCE & TECHNOLOGY AND INDIAN WOMEN

Science and technology development in India is as old as Indian civilization. Knowledge was accumulated by people through the practice of everyday life. The social organisation of society defined people's roles, responsibilities, opportunities, access to resources, and consequently their experiences. The dynamic interaction and interdependence between human beings and natural resources in the pre-modern society led to a relationship of coexistence. Religious beliefs too did not separate the material from the spiritual. Science and technology flowed from this experiential knowledge and the search for coexistence. Diverse practices of knowledge creation and expertise continued to spur local science and technology innovation, with sensitivity to both the 'scientist' and the 'resource' used.

But the dominance of Brahmanism and its attendant ideology of purity and pollution kept women and so called lower castes, especially the shudras and the ati-shudras (the groups recognized as backward and scheduled caste today), out of the discourse and institutions of science and learning in India since time immemorial. This exclusion of Indian women, and men of the so called lower castes, from the realm of knowledge and consequently vocations of science and technology continues to this day. Political processes have ensured that men and women from the tribes, religious and ethnic minorities¹ have joined women and lower caste men in the excluded category. These exclusions to date continue to draw legitimacy from religious text, tradition and social custom.

¹ Henceforth in this document we will focus on women although we recognize that similar exclusions have occurred with regard to men of marginalised communities such as those from the so called lower castes, tribes, religious and ethnic minorities.

Modern science came to India as a handmaiden of colonialism. A vibrant nationalist discourse on science and technology opposed this imposition of a 'foreign culture' on the Indian people. But a dominant section of the elite political nationalist leadership was attracted to the discourse of 'rationality' and 'objectivity' in modern science. The material benefits of the industrial revolution and the possibilities of building military strength through the deployment of modern science and technology also played a significant role in the adoption of modern science by the independent Indian State.

The post-Independence Indian state accepted the approach of modern science to women as well. Indian women's knowledge and expertise has been devalued at two levels. On the one hand the responsibilities attached to women's socio-cultural roles are considered as 'reproductive' thereby denying their contributions any 'economic value' vis-à-vis 'productive' responsibilities of men. On the other this experiential knowledge and expertise is termed unscientific as it is not generated from following the scientific method – the 'objective' observation systems prescribed by formal science. Consequently women's scientific knowledge based on life experience continues to be ignored.

Further, given the gender bias and discrimination in society and in governance institutions, girls and women have remained largely outside bastions of mainstream education. Socio-cultural perceptions of women's roles and abilities translate into active and institutionalised discouragement for pursuing subjects such as science and mathematics to even those small numbers of young girls who manage to stay enrolled in schools. This effectively circumscribes women's opportunities for broadening their knowledge base and pursuing vocations in science and technology.

The Indian state, though invested with the authority to legislate to reverse exclusion of women, because of its acceptance of the modern science *in toto* neglected the issue of women's role in science and technology. Further, because of its firm belief that development was threatened by overpopulation, it actively and in a single-minded manner promoted the policy of controlling women's fertility through its health infrastructure and medical personnel. Scant attention was and is given to risks and harm to women's bodies in the execution and attainment of the goal of population control. The alarming number of "missing girls" due to use of prenatal sex-determination diagnostic techniques and subsequent abortions are in no less measure a consequence of the state policy of turning a blind eye to "late abortions" as they are of the patriarchal preference of families for a male child.

These dual processes of marginalization of women's knowledge on the one hand and the objectification of women to reproductive bodies to be controlled on the other has defined women's relationship with science and technology in independent India. It has led to a devaluation of women's capabilities and increased their alienation from science and technology. Consequently women's realities and world views are not represented in science and technology innovation, creating a vicious cycle of knowledge politics. The deification of science ensures that scientific and technological goods and services provided by the State are accepted uncritically and the abuse of women's bodies in the name of science and technology continues unabated to date.

A MANIFESTO FOR SCIENCE & TECHNOLOGY POLICY: PUTTING WOMEN AT THE CENTRE

In partnering with the STEPs Centre, Marathmoli proposes to create a space for the engagement and inclusion of the voices of marginalized women from India on elucidating the relationship between science, technology, innovation and development. Marathmoli proposes to build a guiding framework for a gender just science and technology policy in partnership with grassroots communities across the country that is rooted in the aspirations, concerns and rights of the most vulnerable sections of Indian society.

Marathmoli recognizes that the processes of knowledge creation and ways of doing are not the same for all women. Women's relationship with nature and society and thereby their experiences are not homogeneous, rooted in "biology". Defined by the institutional processes of caste, class, race and other socio-cultural differences that mediate gender, women's differential experiences generate a plural knowledge base. Marathmoli accepts the 'situatedness' of women's knowledge and insists on the extension of the principle of subjectivity, by now well accepted in the physical sciences, into the general domain of science and technology. It underlines the criticality of including women's knowledge, their subjective and objective realities, and their perceptions of sustainable development (of humans and environment) into the core science and technology innovation. It calls for an inclusive framework and recognition of plural discourses and practices in science. This understanding derives from Indian women's experiences of exclusion; devaluation of their knowledge and abuse of their bodies. Marathmoli's vision of a science that legitimises knowledge created and innovation developed by women, and other marginalised communities, stems from women's experience of nature as plenitude and co-existence with it. It rests on an understanding of science as practices and innovations generated in everyday life to satisfy the needs of production and reproduction of life, art, culture and society for a life with dignity. This vision is informed by and is sensitive to the historical exclusionary processes of the existing edifice of science, technology, innovation and development. Such an inclusive modern science would value and build upon the knowledge repositories of women that have sprung from their myriad socio-cultural and economic roles and responsibilities.

Therefore Marathmoli asserts that the first task of any endeavor that seeks sustainable development for the marginalised using science, technology and innovation is to first unmask the hegemonic scientific discourse and lay bare the hierarchies on which it stands. The claim of modern science and technology to be serving all humanity needs to be taken apart and acknowledged for what it has been: a consolidation of a process of development that serves the interests of a minority while transferring the risks to a voiceless majority and causing irreparable harm to nature. Ostensibly value neutral technologies have systemic risks for certain social groups. For instance technologies developed for detection of genetic abnormalities have been rampantly misused in India for sex-selection with disastrous consequences for the sex ratio at birth. Therefore this endeavor will necessarily have to unequivocally accept that science is more than the scientific method; that science is embedded in social relations, culture, politics and economy and its preeminent position in the edifice of knowledge is a result of a politics of knowledge which its discourses and practices unendingly sustain and reproduce. Dismantling knowledge politics, the scientific establishment will have to recognize the existence of diverse forms of knowledge and their equal value.

Women's Traditional Knowledge

In a primarily agrarian society women's experiential reality of everyday struggles for survival -- the struggle to till the land and grow grain, the foraging for food and fuelwood in the forests, the hunt for precious roots and herbs to cure a child's illness -- enable the development of an indigenous knowledge base. Women are the seed selectors and seed preservers, they are the ones who cook and feed families, they are the nurturers of vulnerable babies and toddlers, and the caregivers of older folk. Inevitably, then, they learn the secrets of seeds and foods and herbs, find ways to preserve valuable foods and use plants, fruits, herbs and foods to provide nutrition and maintain health and wellbeing. This knowledge is derived from close observation and experimentation and transmitted over generations through food culture and herbal lore.

Take for instance, the traditional knowledge of the peasant woman regarding the vital task of selection of seed by culling out the best varieties and carefully preserving them till the next sowing season. Or women's post-harvest ingenious methods of safe storage such as drying, pickling and otherwise preserving a range of foodstuffs, preventing them from rotting, fungal and pest attacks. These are crucial activities that require scientific observation, innovation and creativity and some understanding of basic chemical processes. A sensitive plural science, technology and innovation establishment would acknowledge these contributions of women to agricultural science and technology and give women access to modern scientific ideas, processes and technologies. The resulting cross-fertilization and the products developed would be best suited to the needs, and requirements of the local communities and the long term sustainability of the environment. The women would be able to assess the viability of these processes and ideas using indigenous ways of knowing, and using alternative parameters, such as biodiversity, food and nutritional security, that go beyond the simplistic singular axis of productivity.

Although women's traditional knowledge has still to be adequately recognized, documented and validated, their role as preservers and practitioners of this knowledge base is already being appropriated by market forces. Increasingly, this role is being taken over by national and international scientific establishments and seed multinationals driven by profit. In the process indigenous biodiversity is being lost and the peasants' control over their crops and livelihoods is threatened.

Women's religious roles as the practitioners of religious rituals and customs establish a special relationship with and reverence for the eco-system. For instance, knowledge of the properties of the tulsi plant and its uses for warding off coughs and colds has led Hindu women to grow it in their courtyards and worship it every morning. Similarly, the turmeric root is valued for its antiseptic properties, considered auspicious and routinely used in the preparation of food and in religious rituals. Many other plants and trees are valued, worshipped and used in folk medicine. As caregivers women have had to find and devise folk remedies for ailments and illnesses, experimenting with potions, brews and powders made of leaves, roots, shoots etc. Tribal women in particular grow up learning to find and identify roots and herbal plants in the forests that have medicinal properties. Modern medicine has appropriated some of this knowledge to produce a variety of drugs, patenting it for profit.

Peasant women have also used their knowledge of crops to provide nutritional security for their families. In the process women have preserved biodiversity in agriculture, often resisting the call of men farmers and agricultural scientists to adopt modern practices and varieties as well as

monocropping and cash crops. But instead of trying to understand these linkages between food practices and nutritional balance, agricultural science and biotechnology has focused research on developing genetically modified crops with additional nutrients that are not native to the species.

Women have also used their knowledge and expertise of agriculture and forests, derived from their work and socio-cultural practices, to increase their control over “women’s problems” such as irregular menstruation, menstrual cramps and vaginal infections, and for facilitating labor, improving lactation, etc. One may find many of these herbs in medicinal botanical texts but when used by women they are dismissed as “kitchen spices” or “old wives tales”. Thus it is evident that women, through observation and experimentation and standardization, developed remedies from herbs and food crops to meet their own specific health needs as much as those of their family members. Modern medicine on the other hand has adopted an approach that solely focuses on pharmaceutical drug research and treatment in large global private institutions. And if any of the women’s medicines are found to have pharmaceutical uses then they are appropriated as private knowledge and patented products for private profit.

Enabling Environment

Women’s knowledge in these domains cited above and many others needs to be valued and mainstreamed. However, cognitive justice alone, though necessary, is not a sufficient condition for women’s knowledge and science to become a part of this plural discourse and practice. Women themselves no longer value or recognize the worth of their knowledge and science. Their faith in their own ways of knowing and doing needs to be re-established. Their domains of knowledge creation and innovation are restricted to their socially ascribed roles and their access to opportunities is determined by the socio-cultural environment. This dis-empowering socio-cultural environment also denies women the experiences, mobility, leisure and resources necessary to pursue science and technology innovation.

Science education, research and policy have to incorporate women’s knowledge of science and women’s scientific achievements through practices in daily life into their core vision, agenda and practice. Enabling structures, institutions and processes have to be put in place if true engagement and participation of women in this radical enterprise of science, technology and development is to be achieved. These policy processes should have a sensitivity to the impact of generational exclusion on women and put in place specialised mechanisms that would support them to overcome the challenges of 'slow adoption' in these newer domains.

Further, the incorporation of women’s knowledge should be achieved in a manner that will lead to women retaining access and control over it. Also women and their communities rather than the private corporations -- national or multinational -- should have proprietary rights and patents over the application of this knowledge so that they benefit in monetary terms as well. Appropriate technologies should be developed and education and skills imparted to women to process their traditional foods and medicines in their own locales and manage production for the market.

But even the above changes would be insufficient unless and until modern science stopped seeing women and women’s bodies as objects of research, and went beyond the preoccupation with controlling women’s fertility cycle and reproduction. This would entail giving women a voice in deciding the scientific research agenda on women’s health and paying attention to the

risks of proposed technologies and products aimed at them. The medical and scientific fraternity would heed women's cries for control, safety and sustainability of their own bodies. Thus instead of medical research and technology focusing on newer and newer fertility treatments and technologies, attention would be given to studying the risks of these to impregnated women and their offspring. Similarly before approval of contraceptives such as emergency contraceptive pills, injectibles, and hormonal implants greater attention would be given to studying the likely harm to women's bodies. And before adopting technologies such as vaccinations for cervical cancer, other safer, less intrusive and inexpensive methods of addressing the problem such as prevention, screening, detection and early treatment would be explored and adopted. And state investment would be in research on local food and nutritional practices to reduce women's malnourishment and improve their poor health status rather than on programs for sterilization of women to reduce population. Scientific research would focus on women's illnesses throughout their life cycle rather than on reproductive health and child-bearing age. Technologies would be promoted that would enable women control over their own bodies and ensure that their safety and well being are not threatened. Women would be seen beyond their roles as reproductive beings and as equal participants in economic development.

Appropriate technologies would be developed that are sensitive to women's needs and requirements for their activities within the household and outside it. Their work would be recognized and learnings from their diverse work practices and workplaces ranging from the rural to the urban would be incorporated into science, technology and development policy. For instance, women's work fosters close links between them and the environment, deepening their understanding of non-pollution, and safe and sustainable use of natural resources. While taking fuelwood from the forests or water from the springs women realize that these resources must be preserved and used sustainably, as overuse could threaten the survival of their communities. Their dependence on nature teaches them to use it wisely, rather than destructively.

Conclusion

The institutionalization of experiential knowledge and expertise, rooted in the values of coexistence and sustainability, would drive a change in the directionality of contemporary science and technology policy. It would validate women's experiences and underscore the practices of sustainability in their interaction with nature and in their control over their own bodies. The internalization of these practices of sustainability in the emerging domains for women's participation would lead to a broad based culture of innovation that calibrates risk in the context of coexistence. A supportive policy environment would nurture and validate plural ways of knowledge creation and expertise through the creation of opportunities to ensure full participation of the marginalised in all domains of science and technology development.