

# Impact of Science and Technology on Women

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**I**t has become imperative for a developing country like India that the pace of development needs to be commensurate with the growth and development in the field of science and technology. In this new scenario, characterised by modernisation and industrialisation, the advantage of a nation largely rests on the competitive advantage it can have particularly in its ability to reconfigure knowledge. While most countries rely on technological innovation as an important strategy to get ahead of the rest, the concerns of women and the poor who constitute the vast majority of the population is often forgotten. Bringing women and the poor to the forefront of the S&T policy is a challenge. In other words, in the journey of competitive science how can India be more inclusive?

## Women and S&T Policies in India

The National policies on Science and Technology in India have, over the decades, made shifts to engage with science technology and innovation as reflected in the more recent Science Technology and Innovation Policy of 2013. Earlier, India's Policy Resolution of 1958 assumed that technology would flow and be the logical next step from these scientific institutions/ establishments.

To provide the much needed filip to technology, India introduced the Technology Policy statement in 1983 with a focus on technological competence and self-reliance.

A review of progress of the earlier policies of S&T in India indicates that there was a need for a synergy between science technology and innovation to make impressive strides towards progress in society. Though science and technology have historically excluded women, it was hoped that, with the addition of innovation, there would be greater participation of the under privileged and women in general. Innovation in the Indian context has had a more equitable participation of the poor and women, which is illustrated through the several rural innovations documented by the National Innovation Foundation. And this is only the tip of the iceberg, in an ancient country like ours which has historically been engaged in innovation based on traditional knowledge. The current Science Technology and Innovation Policy of 2013 has the potential to expand participation in science and technology to every section of society.. More importantly, the policy emphasises the need to integrate programmes of the socio-economic sectors with research and development to address national problems. The mention of women for

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the first time in the S&T policy of India has been through a short section on gender parity. The focus of this section has been on the importance of increasing the participation of women in STI activities, thus on women STI professionals. While this is a critical step to link science with society and more importantly to women in society, it does not address (though it can if it wants to) the needs of millions of women who constitute the vast majority of our society.

Having said this, it is important to recognise that the current STI policy opens two windows to allow science and technology to impact women. While the first is to build bridges between science and technology with socio-economic sectors and address national problems; the second is through an increased and real participation of women S&T professional to shape the research agenda of this country.

The advancement of science and technology has been largely pre-occupied with increased resources for R&D and make India globally competitive. In this journey, very often the priorities of STI are in consonance with global needs and often relegate the local and national needs to the background.

### Science, Technology and Women

It is interesting to note that the earlier discussions in India regarding science and technology on one hand and women on the other has been constructed post independence in the domain of the privileged sections of society reflected by the English speaking, upper castes/class, men in urban areas predominantly. Thus, the earlier interface of science and technology with women was in the form of recipients of development. The privileged men from predominantly urban backgrounds were the benefactors. In an attempt to reach out to the vast majority of the population predominantly the lower castes/classes; rural; and women who were largely illiterate and still

out of formal education system, scientists and technologists focused on domestic daily needs like low cost efficient fuel, drinking water, efficient agricultural equipments to reduce the drudgery of labour, among others. While science and technology research in the above areas was pursued only by a miniscule number of scientists, the vast majority of the S&T professionals were engaged in big funding projects reflecting the global agenda.

### Women in Science in India

Today, the statistics of participation of women in science is extremely encouraging with almost equal participation of women in science courses in the under graduate and post graduate levels. India, unlike most countries in the west has a leaky pipeline not at the school or college levels but at the doctoral level.

**Thus, as a compromise, a large number of qualified women scientists opt for under-graduate or school level teaching, while others completely drop out of science.**

Despite this, women's participation at higher levels of Science in tenured research positions has shown little increase.<sup>11</sup> Women constitute over one-third of the total science graduate and post-graduate degree holders but comprise only between 15-20 percent of the tenured faculty across research institutions and universities in India (INSA Report, 2004). Further, the relatively higher representation of women is seen in the low status jobs (e.g. junior/ ad-hoc faculty, temporary research associates, post-doctoral fellows, etc.) in science that have been vacated by men due to their lower profitability. As Bal (2004) has pointed out, a permanent position with the ability to undertake research projects with appropriate institutional facilities, advise doctoral students, and publish is important for a stable career in science. Since competition to remain and advance in science

careers begins at the earliest stage soon after PhD, it is important for women to establish themselves during their early 30s, a period that coincides for most Indian women with marriage and family commitments. Thus, as a compromise, a large number of qualified women scientists opt for under-graduate or school level teaching, while others completely drop out of science.

Even though there is recognition of this 'winding career path'<sup>2</sup> for women, science policy makers often ignore the willingness and need for women to stay active in research despite their other responsibilities. Absence from active research through breaks cannot be compensated for at a later stage in the highly competitive environment of science. Therefore, policies designed to provide extended maternity breaks or temporary research projects may actually not address the central problem and may instead work against the interests of women.

Keeping these factors in mind, a study was conducted by the Indian Academy of Sciences in collaboration with the National Institute of Advanced Studies in order to develop a set of recommendations from the actual experiences of and data obtained from women scientists. Acknowledging the diversity among women scientists (Kurup, A., et.al, 2007), efforts were made to include women who have continued in science as well as those who have dropped out.

**Sample and Methodology:** A survey was conducted with 568 women scientists, of whom 312 were engaged in science research (WIR); 182 were engaged in positions other than long-term science research (WNR)<sup>3</sup>; and 74 were not working (WNW). In addition to representing the diversity among women, another unique aspect of the study was the inclusion of men scientists (161) as a comparative group.

Evidence from this study suggests that organizations play a vital role in affecting women's careers through



Data from the study debunks the common assumption that domestic responsibilities and gender-role status of women are responsible for women's drop-out. These assumptions invoke explanations of social attitudes and values and need for change at the societal level for women's poor retention in Science. Instead, the study shows that these factors can be easily addressed through a revision at the organizational and policy level.

The study reveals that despite family and childcare, women work in different ways to put in the ideally required number of 8-10 hours per day for research. While this may not be an indicator of quality, the findings convincingly disprove that myth that women cannot provide enough time for work and research after marriage and childbirth due to family responsibilities.

The data reveals that there is a largely prevalent perception by men that women's domestic responsibilities hinder their optimal performance in Science. However, there is a lack of recognition awarded to women's commitment and ability to manage multiple responsibilities, and the utility of organizational provisions in aiding women's management of career and family.

supportive or disabling mechanisms. Women scientists report flexibility in timings to be the most useful organizational provision. This entails starting the work day earlier or ending later, depending on one's multiple domestic responsibilities.

A high proportion of women have, however, indicated not taking up previous jobs due to organizational factors such as long, inflexible hours, no room for professional growth and lack of childcare facilities compared to men. Thus, for women more than men, organizational structures that



ease the work atmosphere and help balance family life are important.

Prime among the organizational recommendations made in the report is for provisions to manage multiple responsibilities – such as providing accommodation on campus, transportation, childcare and eldercare facilities, etc. While such provisions, where available, are mostly given on seniority basis, there is a need to prioritize such options for younger couples between the 30-40 years age-group, since they would be the likely ones with young children.

**A compulsory gender audit with mandatory requirements for all research institutions, universities and national laboratories to provide department-wise gender breakup of students and faculty at all levels needs to be implemented.**

In addition, there is a need to provide flexibility in timings to help them balance family responsibilities along with work. Flexibility does not imply work from home without spending the required hours in the laboratory. Rather, it emphasizes the need to support women's commitment to put in the mandatory number of hours at work even when children are younger through extension of office hours.

Further, an important organizational mechanism to retain women would be to introduce mentoring programmes with incentives for mentors to be accrued during the time of performance appraisals and promotions. Mentors and role models will be extremely useful to overcome the general perception among students/parents/public that the work-life balance for women in science may be difficult to achieve.

A compulsory gender audit with mandatory requirements for all research institutions, universities and national laboratories to provide department-wise gender breakup of students and faculty at all levels needs to be implemented. Along with this, a Time-bound target Recruiting System (TRS), with an emphasis on increasing the recruitment of women to premier research institutions needs to be implemented.

A large number of women in the study (especially those not currently working) have reported '**not getting the job**' as reason for not taking up jobs. Critical research studies **on selection and evaluation procedures** that examine factors responsible for the lower number of recruitments and advancements for women, a policy on the transparency of selection and evaluation procedures will be important.



In order to increase job opportunities, exploring venture capital to expand infrastructure in science with possible patenting provisions for entrepreneurs who have invested in the research is useful. Another option would be to create entrepreneurial opportunities in Science and Technology for scientists who have completed a PhD in Science, Engineering or Medicine.

There is a need for modification of existing schemes for re-entry for women. The study has revealed that a major problem with such schemes is the short-duration of 3 years, along with delay and lack of efficient renewal process. There is a need to develop a long-term scheme of 5 years duration that can be renewed periodically based on performance. Dependence on institutions / guides for obtaining or continuing such projects needs to be reduced, since these clauses have led to breaks for many women. Instead, it must be made mandatory for all government universities, laboratories and research institutions to allow women scientists in these schemes to undertake research at their institutions. An advisory group, in place of a single faculty member can be constituted to review work and guide these scientists, in order to ensure their autonomy as well as availability of adequate resource personnel to them.

The study showed significant differences in the perceptions of women and men scientists with respect to women's retention in science. With men forming the majority in science organizations and on important committees, the perception that the problem lies in the socio-cultural realm would prevent the development of proactive policies that can address the issue of women's lower participation in science. Therefore, for policies to be effective, it is essential to have at least one-third representation of

women. The data has shown large difference between WIR, WNR and WNW, and some differences across age cohorts. Hence, it is extremely important to implement a system of rotation to represent new members based on merit across different age groups who could provide new insights based on their experiences.

The study advocates for gender-neutral provisions that can be availed both by women and men. This is, firstly, to prevent negative appraisal of women for availing special opportunities and secondly to go a long way in redefining gender roles by providing opportunities for men too, to take on multiple responsibilities.

An essential requirement for these policies is a periodic review to evaluate the extent to which the recommendations have been implemented, or may require modification.

In conclusion, there is a need for more dialogues and collaborations between the physical scientists and social scientists to be able to unravel the complexities of women in science and technology in India. It is equally important for the STI agenda to move beyond women in science to science for women to reach STI to vast majority of women in society. It is through this symbiotic relationship between science and society through equitable participation that can realize the dream of reaching science to women in India.

#### Readings

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#### Endnotes

1. Refer Bal, 2002; 'Science Career for Women', published by INSA (2004)
2. Refer Elgquist-Saltzman, (1992) for an explanation of 'winding career paths for women'.
3. WNR included those in undergraduate or school level teaching, temporary research positions such as DST women scientists schemes and consultancy or administrative posts. The defining feature of the category was working on jobs that may not require training at the PhD level. □

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