Women in science: Trends and contributions of Indian women scientist

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Abstract

Women have made steady gains in recent decades in closing the scientific gender gap but there is still the issue of under representation of women in science. Fraction of qualified women drops out of science careers in the very early stages and it is being seen with a great deal of concern all over the world and same trend follows in India as well. This situation is a serious obstacle in achieving gender equality, since the underlying reasons for the situation is multi-faceted. Especially in Indian context one of the main reasons is lack of role model, much more needs to be done to address the reasons behind and entice more women to enter and stay in science. Achievements of Indian women scientist needs to be highlighted more to encourage women scientists as well as inspire girls and women to take up careers in science. This paper attempts to highlight the overall status of Indian women in science, figures about the women's presence in various reputed national agencies and constraints to opt for science career.

Keywords: Women scientist, gender equality, science, Indian women scientist.

Introduction

Indian women have overcome the traditional mindsets and excelled in professions like teaching, medicine, life science and politics. But they still face significant socio-cultural and institutional challenges in establishing, maintaining and advancing their careers in science-related fields. Marginalization of women in science related careers is a worldwide phenomenon, and India is no exception. Subrahmanyan (1998) in her collective biography of full-time women faculty of sciences concludes that women scholars suffer from attitudes which hamper all scientists from the third world, while their careers are restricted by the constraints imposed by an essentially patriarchal society. Presently at high secondary, undergraduate, post graduate and Ph.D level, proportion of women participation is not low. However, these figures do not correspond for higher positions in universities and research institutes where they comprise only between 15-20 percent (INSA Report, 2004). Though the number of women in scientific research is going up lately but where academia crosses into industry, like patenting their discoveries, starting biotech companies the trend less progressive.

Many experts say that a big factor driving this trend is the lack of role models which have been slow to change. It is important to educate women in the field of science, because science education not only enhances awareness level but also builds a mindset with an ability to judge with a scientific approach to cope up with the problems being faced by them and society at large. Hence, addressing these challenges should be a strong priority for any nation especially a developing country like India and gender in science

has to be an important area of study for social scientists. In Indian context more focus should be on highlighting the achievements and recognition of Indian Women scientists, so that they can be the role models and become instrumental in attracting young girls into science. Therefore in order to bridge this gender gap in science and for improving opportunities for women to achieve their full potential in science-related careers, workshops and awareness programme needs to be organized across the country to discuss the issues, challenges, and opportunities in the field.

Methodologies

This is a retrospective and descriptive type of paper which is based on secondary data published in open access sources; research articles, report of different Government as well as educational institutes.

Trends, observations and analysis

With the increase in educational graph of India in the 20 th century, women made their presence felt not only in biological sciences but have entered into all disciplines of science & technology. Presently, in India series of intellectual, research and developmental initiatives are been developed with a view to empower women in all respects. Despite this, gender gap persists, particularly at higher levels of academic excellence and especially in S&T and R&D institutes. Science is one of the areas, which has been a traditional stronghold of men in India, with very little opportunity for women to rise to decision-making positions. Ideal female student strength of 50% is yet to be achieved; the percentage of girls studying engineering is even lower than in basic science. There is a drastic drop in the percentage of women from the doctoral level to the scientist and faculty position suggesting a bottleneck at the employment stage. In 2004, the Indian National Science Academy (INSA) had constituted a committee to evaluate the position of science careers for women, and suggested measures to increase the participation of women in this field. The committee found that the women who pursue careers in science typically take up teaching jobs or faculty positions in Universities. Positions of scientists and researchers are rarely filled by women and very few women have been recognized for achievements in the field of science. Women heading the laboratories, science departments of the government or as members of governing or advisory bodies are rare. Probably the first data on women scientists were collected in 1975 when the Indian Women Scientists Association was formed (Krishnaraj 1991). Begum and Balaraman (1975) surveyed women scientists in the research establishment in India and they concluded that women had to work harder than men to progress in their careers.

Indian women in science by virtue of the fact that they are women, they face situations that are quite distinctive and related to their role and status in the society. The issues unique to women scientists in India have been beautifully brought out in an Indian government report (2006) by a team led by Dr. Mahtab Bamji. A recommendation made there was to form a Standing Committee of the Government of India for Women in Science; with an aim that one could structure government policies towards encouraging

women in S&T. The Quantitative data on women scientist particularly in Research and Development and Science and Technology reveal the following scenario according to the reports of Indian National Science Academy (2004), the proportion of women in national laboratories and prestigious universities is less than 15%, except in DBT and ICMR where the percentage exceeds 25%. Tables I and II provide details:

Table I: Women Scientists in some R&D Agencies in India

R&D Agencies	Total Scientists	Women Scientists	Women %
CSIR*	5528	595	10.76
ICMR	615	168	27.31
ICAR**	4542	540	11.88
ISRO	11057	1056	9.55
DBT & Autonomous Institutions	456	121	26.53
DST	147	18	12.24

Table II: Relative Presence of Women as Scientific and Technical staff in Government R &D Institutions and some Universities

Organization	Grade of the scientist	Scientist-total	% women	Technical-total	% women
CSIR	-	5030	13.0	3250	14.0
DBT	-	179	31.8	277	23.1
ICMR	-	615	27.3	1939	20.1
ICAR	Asst.Prof.	12750	10.4		-
	Asso.Prof	4750	6.2		
	Prof.	2500	3.5		
IISc	Academic	316	6.6	34	14.7
	Scientific	113	9.7		
University of Hyderabad		101	15.8(only one professor)		
Jawhar Lal Nehru University		82	16	20	0

There is significant participation of women studying science as well as in teaching science in schools and undergraduate colleges. But they form a peripheral group in the natural and physical sciences and in engineering not mainly involved in pursuing scientific research as a career. In the study of women scientist in Indian university system by Bindu Bambah, (2015) points out to the fact that Marie Curie, Rosalind Franklin and Barbara McClintock are the only women scientist role models for women students,

researches and faculties. This suggests that successful Indian women scientists are not being projected as the motivational role models at all levels in scientific ladder. This is a serious lacuna in our education system, despite the fact there are many eminent women not many are seen being awarded and rewarded. To cite an example the INSA report shows that the prestigious Academy fellowships to the leading Academies of India namely Indian National Science Academy (INSA), New Delhi; Indian Academy of Sciences (IASc), Bangalore and National Academy of Agricultural Sciences (NAAS), the percentage of Women Fellows are dismal (INSA 3.2 %, IASc 4.6%, NAAS 4%). One of the most prestigious awards by Council of Scientific and Industrial Research (CSIR) is Bhatnagar prize out of 333 awards since 1958; only 8 women have received it, up to 2004; while none in last 6 years including 2004. Coming to the younger generation of the scientific community, out of 468 young scientist awardees since 1974 –2005, women awardees are only slightly over 9 %t.

Subramanian (2007) documents the experiences of women scientists at the Indian Institute of Science, Bangalore and the Indian institutes of Technology (IIT's) and uses the data, narratives, and interviews to conclude that, contrary to the claims made by the institutions in deciding who gets to do science, gender plays a significant role at various levels in shaping the career of a scientist. (Gupta and Sharma, 2002) in '*Women Academic Scientists in India'* analyzes the participation of women academic scientists through a survey in various institutions such as IIT (Delhi), IIT (Kharagpur), J.U (Jadhavpur University), IIT (Roorkee) and reveals that only 4% to 8% of the faculty is female. The more recent book '*Women in Science in India-a reader*" (Kumar, 2008), provides a comprehensive survey of the literature of women in science in India. This collection outlines the challenges faced by Indian women and attempts to broaden our understanding as why women continue to be discriminated in science despite legal and constitutional laws and emphasized on need to analyze the social and work environment of women scientists.

Contribution of Indian women scientists

Giving more visibility to successful women in the field, their contributions and efforts should highlighted more according to recommendation from different organization for gender in science. It is very important especially for young girls with research ambitions, to know of women who functioned and achieved their goals in the Indian social and academic environment. There have been some great Indian Women scientists who have marked their excellence with their research work in their respective fields;

Janaki Ammal Edavaleth Kakkat (1897-1984) a well known Indian botanist, first Indian woman to obtain Ph.D in Botany (1931), her field of scientific research includes cytogenetic and phytogeography. Her most notable work is on sugarcane and the eggplant (interspecific and intergeneric hybrids). She is best remembered for co-authoring the monumental work, "*Chromosome Atlas of Cultivated Plants*" along with C. D. Darlington. The Government of India conferred the *Padma Shri* on her in 1977. In 2000, the Ministry of Environment and Forestry of the Government of India instituted the National Award of Taxonomy in her name in 2000. To promote excellent work in taxonomy and encourage young students and scholars to work in this field, the E.K.

Janaki Ammal Award was instituted in the year 1999. **Maharani Chakraborty** (1937-2015) she was a molecular biologist from India who did intense research in genetic engineering field well known for organizing the first laboratory course on 'Recombinant DNA' techniques in Asia and Far East in the year 1981. **Anna Mani** (1918-2001) she was a pioneer physicist who did intense work in the field of meteorological instrumentation and solar radiation. She was among top women scientists and researchers of India whose contribution was internationally recognized. She retired as deputy Director General of the Indian Meterological Department but kept on working till her last breath. **Tessy Thomas** (1964) ISRO scientist who is popularly tagged as 'Missile lady' due to her association with the successful launch of Agni series (IV) of missile in the year 2011. She is the first women scientist of India who headed a missile project and was honored with 'Lal Bahadur Shastri National Award' for her outstanding contribution in the field of missile technology in India. **Mitali Mukerji (1967)** Senior Principal Scientist at the CSIR Institute of Genomics and Integrative Biology with notable achievement in the field of human genomics. Her work largely deals with personalized medicine. She is also involved in an innovative study titled "Ayurgenomics", which is blending of Ayurveda the traditional Indian system of medicine with genomics. She is recipient of the prestigious Shanti Swarup Bhatnagar Award (2010) for her contribution in the field of Medical Sciences. **J Manjula (**1962) she created history in India's defence research establishment – an outstanding scientist of high repute, took charge as the first woman director general of the Electronics and Communication Systems cluster of the Defence Research and Development Organization (DRDO). Manjula is the recipient of the DRDO Award for Performance Excellence, Scientist of the Year 2011. **Sunita Narain (**1961) Environmentalist and political activist Sunita Narain is the Director General of the Centre for Science and Environment and the Director of the Society for Environmental Communications. She is also editor of the fortnightly magazine, *Down to Earth* and a Padma Shree awardee. **Vijayalakshmi Ravindranath**(1952) a neuroscientist, Padma Shree awardee, she is the Chairperson of the Centre for Neuroscience at the Indian Institute of Science, Bangalore. She was formerly the Founder Director of the National Brain Research Centre, Gurgaon. Her main area of interest is the study of brain-related disorders, including neurodegenerative diseases. These women scientist of strong determination and dedication who never gives up their passion for their work and keep on marching forward with an internal strength and strong motivation. Given a chance, there will be many more in the years to come.

Schemes and initiatives

The government of India is beginning to realize the problem of lack of career opportunities and hurdles in career advancement for women in science related fields. In July, 2009 the Minister of Science and Technology in New Delhi acknowledged that the number of women scientists in India is very low, and there are multiple problems that need to be resolved in this regard. The government is considering making "Gender Audits" compulsory in scientific establishments. Based on the findings of INSA report on "*Science Career for Indian Women*" 2004 and Centre for women's studies, SNDT University, Mumbai, a set of recommendations was made to improve the situation. The Ministry of Science and Technology, Government of India, constituted a National Task

Force for Women in Science under the Department of Science and Technology (DST). The report entitled "*Evaluation and Enhancing Women's Participation in Scientific and Technological Research: the Indian Initiatives*" released in December 2010, further examined the status of women in science (which had not changed substantially from the earlier INSA Report), and made more specific and detailed recommendations. Continuous updating of data on gender and science and technology is one of the recommendations in the DST Report. To encourage the participation of women in the field of science, the Indian government's Department of Science and Technology (DST) has come up with an innovative Women Scientists Scheme (WOS) that aims at providing opportunities to women scientists and technologists between the age group of 30 to 50 years. The DBT has a useful and successful program to provide ways and means to encourage, empower women on the career path, like Biotechnology Career Advancement and Reorientation Programme for Women Scientists (BiO-CARe). The University Grants Commission (UGC) has also instituted five-year fellowships for women to provide a pathway to reentry to programs in basic research. Apart from social support for women to pursue career in science, a change in attitude is the need of the hour.

Discussion and Conclusion

Girls are not culturally encouraged to think of themselves as scientists and the status of women in science in India is a matter concern. A striking observation is the major paucity of women at the senior most administrative and policy making positions in scientific institutions. Root of the problem is that there is still an assumption, conscious or unconscious, that a man is better suited for highly responsible jobs and advanced technologies. This does not encourage most women, who do not have the confidence to embark on a career unless they receive strong support and encouragement. The most important thing for woman across developing countries is the health of her family and education of her children. The unequal sharing of family responsibilities and criticism from society that she is neglecting her children are some of the reason for the under representation of women in S&T employment often makes women quit work. For a woman the task of doing high quality research is doubly difficult because the productive phase of research coincides with the childbearing phase.

Women alone cannot solve this problem; mass awareness amongst the scientists, government officials, entrepreneurs, teachers and NGO's is need of the hour. The contribution of women to science and technology should be highlighted more. The family-friendly policies like parental leave, daycare supplement, and emergency care for children and elders needs to be implemented. Women who work in all STEM fields to mentor women researcher, promote positive female role models and images in the classroom, workplace, community and home. There is a need to develop avenues to promote entrepreneurship and self-employment for women scientists. Women scientists in India have confirmed their intellectual abilities and wide range of skills. It is now time to eliminate the remaining obstacles that keep them from becoming fully involved in their work including leadership of science and technology innovation. It is time for the society to realize and accept the fact that women's contributions and efforts cannot be ignored any longer.

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