Role of Women in Science and Technology in India

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Abstract **- The evolution of science is like a boon to the world, as human beings come to know a lot about the world they are living in including the activities they indulge into. Furthermore, the development of technology along with the advancement in Science helps to bring in a revolution in various fields such as medicine, agriculture, education, information and technology, and many more. Science and Technology are the main components for social and economic development of a nation. The rapid growth of technology and concurrent digital revolution is creating a tremendous cultural shift globally. Science and Technology has permeated into every sphere of life and has become a part of day-today living. In India, there is a priceless contribution of great scientist like C.V Raman, Vikram Sarabhai Meghnath Saha, Dr.A.P.J.Abdul Kalam in development of science and technology but many of us are unaware of the contributions of Indian women in field of science and technology. It is observed that throughout India, and amongst the relatively developed countries of the world, the presence of women in highly prestigious Science Institutes and Universities is very small. In this paper the probable causes behind such inequality is discussed. This paper also presents the role played by Indian women in science and technology and also highlights some of the basic issues affecting the progress of women in field of science and technology.**

INTRODUCTION

Fifty percent of our precious human resource that is women are an integral part of overall socio-economic development of the country, and in rapid progress of Science and Technology. Their education is crucial not only for the society, but for building the strength of country, particularly when women pursue Science as their career. For centuries, women have passed on their skills on how to manage water, forests and biodiversity; use and preserve medicinal plants; to manage waste and sanitation. Harnessing women's local knowledge and skills is critical for protecting, sustaining and managing the environment and its resources. Women occupy key positions at the household, local and community levels from the earliest times. Women were barred from education itself earlier. The idea prevailed that education would distract women from their natural roles as mother and housewife. Science and technology has been considered as subject for men only for a long time and this gender gap is observed in most societies. The old age concept of women being intellectual weaker is supported by some socio-economic factor. The first factor that a stereotype of men being better at math and science is inculcated from childhood itself [1-2]. This concept might discourage female students to pursue their career in science or technology. Next one that there is the longstanding belief that science and technology are masculine subjects, since they deal with the technical aspects of nature [3-4]. Historically, the female intelligence was always believed to be inferior to male, fueled by Eugenics and Genetics. The hypothetical relationship between skull size and intellect supports the concept of intellectual inferiority of women [5-6].

In India, women are traditionally represented as more gentle, nurturing, obedient and self-sacrificing and they are considered to be technically less skilful than men. Their emotional and nurturing qualities are stated to help them fulfill their roles as homemakers and caretakers of the family. This is an immense question in India even today in 21th century that women deserve equal rights and opportunities as men, yet they faces challenges regularly. The aim of present study is to focus on the contribution of some famous women in field of science and technology and some basic issues faced by women regularly.

HISTORICAL BACKGROUND

The analysis of Indian history tells that woman had a prestigious position in science and education in early Vedic period [7]. Gargi Vachaknavi, Lilavati, Maitreyi are few names who were expert in their respective fields [8-10]. But such a nurturing condition could not prevail for a long time and in 18th century to the mid-

19th century during Islamic era and British Empire, the condition of women in field of education was very poor. After independence in India various social reforms were attempted for equipping women with rights to education and empowerment. India granted voting rights to women immediately after its freedom in 1947. The right to vote was quickly followed by the rights to equal employment and education, to provide better opportunities and social acceptance to women workforce.

Immediately after Indian independence the fraction of women in universities was about 10% and those in the science were fewer than 5%. In 1950, university enrolment in the sciences accounted for about 20% of the total irrespective of gender and by year 2000, women's share in university enrolment increased to about 40%. In case of graduate engineers, the number of women had increased by the end of the last century to about 10% from a negligible beginning in 1950. Globalization has caused a further increase in the percentage of women students in engineering since 2000. Many private engineering schools will boast of about 50% (or more) women enrolment in certain branches of engineering, although the numbers in the more prestigious engineering Institutes (like the Indian Institutes of Technology) still hover around single digits [11].Gender inequality, participation of women in major development activities and getting more women in science and technology are the issues discussed in 1975 when first United Nations World Conference was held on the occasion of International Women's year in Mexico. The various professional bodies in India have made several recommendations and documented the facts and problems faced by women. A report on ''Science Career for Indian Women: an examination of Indian women's access to and retention in Scientific Careers" [12] was submitted by Indian National Science Academy (INSA). Department of Science and Technology (DST) have formed a Task force for women (DST Task Force) and made a report on the situation of women in science and technology in India [13]. The three science academies, viz, Indian Academy of Science (IASc), Bangalore, Indian National Science Academy (INSA), Delhi and National Academy of Science, India (NASI) have played an important role in bringing out main issues related to women in science field.

Status of females in Indian Science and Technology System

In India the fraction of females in science and engineering education as well as the senior position in research and development institution is very small. However the participation of females in all stages of education is increasing steadily through the years. The overall enrollment of females in various discipline in last few decades are shown in Table.1 [14]

Table.1 Enrollment of females as % of total enrollment in University Education in India by faculty

Year	Arts	Science	Commerce	Engineering	Medical	Education
1960-61	18.6	--	1.1	0.8	20.4	32.5
1970-71	33.5	18.5	2.8	1.0	21.3	37.3
1980-81	37.5	27.9	15.2	4.6	23.8	46.7
1990-91	39.8	36.8	24.0	10.9	34.3	44.2
1995-96	41.5	35.5	29.0	14.2	34.5	41.2
1999-2000	44.9	37.4	34.0	16.2	37.8	42.6
2001-2002	43.8	39.1	38.7	24.9	40.6	43.5
2003-2004	45.5	39.8	36.7	23.1	46.3	52.1

It is clear from the table that highest percentage of women is in education discipline. It is considered to be most apt subject for women because it is suitable with their other responsibilities of housewife. Enrollment of females is small in engineering but increases over years. In India fraction of women in research and development activities are very small. According to latest data there are 61050 women are employed in Research and Development establishments, which is about 15.6% of total manpower employed in the country [15]. Among them majority of women involved in administrative activities.12% of women are engaged in R&D activities, 11.5% in auxiliary activities and 17.4% are in administrative activities [16]. The fraction of women on the faculty of institutions of learning, research and teaching is not comparable with the fractions at the Ph.D stage. Major percentage of women are engaged in teaching of science and mathematics in school as well as college level but participation of women as faculty of

prestigious institutes like IITs, IISc, TIFR (Tata Institute of Fundamental Research), BARC (Bhabha Atomic Research Centre) is only about 10-12%. In the report of Indian National Science Academy, it is reported that proportion of women in National laboratories and Universities is less than 15% except in DBT and ICMR where this is 25%. Table 2 and 3 shows the participation of women in different institutes and universities [13].

Table.2 Women faculty in some prestigious Universities

University	2004		2008	
	Total faculty	Women (%)	Total faculty	Women (%)
IISc, Bangalore	Academic: 316 Scientific: 113	6.6 9.7	Total: 330 Asst.Prof.:91 Assoc.Prof.:92 Professor: 147	7.7 9.9 5.5 8.3
University of Hyderabad	Total: 101	15.8	Total: 135 Asst.Prof.:41 Assoc.Prof.:32 Professor: 62	20.0 31.7 40.6 8.0
Jawahar Lal Nehru University	82	16	120	20
Delhi University			Sciences Asst.Prof.:184 Assoc.Prof.:22 Professor:85 Maths Asst.Prof.: 8 Assoc.Prof.:9 Professor: 11	37 6 10 25.0 47.4 18.2

Table.3 Women Scientist in Various Institutes

Institute	2004		2008	
	Total Scientists	Women (%)	Total Scientist	Women (%)
CSIR	5030	13.0	4556	16.05
DAE(TIFR&BARC)	436	16.5	4173	15
DBT	179	31.8	208	27.4
ICMR	615	27.3	561	29.0
DST	--	--	659	20.8
DRDO	--	--	6890	14
ICAR	2000	8.5	2378	14.3

Constraints faced by Women

Women face a lot of challenges in making career in field of science and technology through many of us agree that they deserve equal rights and opportunities as men. They face gender inequality all levels which decreases their opportunities as compared to males. This may be due to their responsibilities in home as mother and home maker as well as due to the traditional concepts and socio-economic condition as well. India is a powerful nation and famous worldwide for being the largest democracy in the world however, women backwardness is very clear in the Indian society because of the social issues, problems and lots of restrictions against women. It is seen that there is decrement in women participation from higher secondary to Ph.D degree. There is a social pressure on women to care of their family which is a very tough for them with a profession career. They are discriminated against at this stage as well, with administrators deciding that women "should" be opting for family over a career. The fraction of women scientists who are unmarried (14%) is much greater than that of similar male scientists (2.5%). The married women scientist as well as faculty members in various universities and colleges recounted that family support is very much essential for working better on workplace. In central and state government institutes there is policy for working women that entitles them to two years of support for "child-care leave", which they can take at any point until their children are 18 years of age. This attempt helps to reduce the pressures of maintaining a family and a career.

FAMOUS WOMEN SCIENTIST IN LAST FIVE YEARS

In India, science and technology profession is man dominating profession. We know about the valuable contribution of male scientists all over the country, but contribution of women is not talked about. Here we will present the immense contribution of some women

in science and technology. These women are source of inspiration for all girls who love science and want to make career in this field.

Tessy Thomas: Tessy Thomas is the first Indian woman scientist who was head of a missile project. She was project director of Agni-IV and Agni-V missile in DRDO (Defence Research and Development Organization).She is known as Missile lady of India and awarded with Lal Bahadur Shashtri Award in 2012.

Shubha Tole: Scientist in TIFR (Tata Institute of Fundamental Research) and famous for her contribution in field of neuroscience. Shubha Tole has discovered a master regulator gene which controls the development of the brain's cortex hippocampus and amygdale and in 2010 she is awarded with Shanti Swarup Bhatnagar award.

Gagandeep Kang: Gagandeep Kang, an Executive director in Translational Health Service and Technology Institute (THSTI), Faridabad played a crucial role in development of rotavirus vaccine. Rotavirus is a virus that causes gut and intestinal disorders among children such as inflammation, diarrhoea, dehydration, and gastroenteritis among others. She was also the first Indian woman scientist to join London's Royal Society.

Kusala Rajendran:She is famous Seismologist, Indian Institute of Science (IISc), Bengaluru. She has done a lot of research work on earth quake and awarded by India's first ever 'National Award for Woman Scientist. Rajendran dedicated the honour to women all over the country, who have to always struggle hard to achieve their goals.

Rohini Godbole: A famous physicist and professor in Indian Institute of Science, Bengaluru. She is an elected fellow at all three Indian Science Academies and Science Academy of the Developing World.

Aditi Sen De: Aditi Sen is professor in Harish Chandra Research Institute. She works on finding the right quantum mechanical system for a quantum computer. She received Shanti Swarup Bhatnagar Prize in physical sciences in 2018, in age of 45 years for her contributions to quantum information and communication.

Muthayya Vanitha & Ritu Karidhal: They are Senior Scientists at ISRO. Vanitha was project director, & Karidhal was mission director of Chandrayaan-2

CONCLUSION

Year 2001 was declared as year of empowerment of women and in this context our former Prime Minister Late. Sri Atal Bihari Vajpai has said that: "Developing countries that have made remarkable social progress, have done so primarily through the empowerment of women, which has had enormous impact in terms of literacy, health, and economic well being of families." Hence we can say that gender play an important role in shaping the society as well as nation. Our social and economic conditions suggest that participation of women in science in India will increase considerably in future. So it is necessary to facilitate ways in which pursuit of science by women can be effective. There must be some measures to be implemented.

- Measures necessary are not just to attract girls to science and engineering, but also to keep them there.
- Awareness must be spread to parents, the family and society that it is not impossible to maintain career and family balance. Eminent women scientists should play a role model for younger girls by mentoring them.
- The women who are doing excellent work in lower level and in rural areas should be encouraged and rewarded.
- Academies of Science have a role to play by mentoring, showcasing work done by women scientists, to an audience of both genders, to create awareness on various career options available to young women scientists.
- Work climate in institutions and organizations should be improved for women. Some policies and initiatives should be taken by the government to improve the participation of women in science and technology.

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