

Opportunities for women in science – The CSIR (extra mural research) experience

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Participation of women in technical and professional streams has shown an increase. This trend is noticed in the case of women scientists engaged in the Extra Mural Research Programmes of the Council of Scientific and Industrial Research. CSIR has encouraged women researchers to undertake R&D by sanctioning them schemes with sufficient grants.

HUMAN Resource Development (HRD) now occupies centre stage in the global arena of development. Gender equality and gender equity are emerging as major challenges. Home to over 400 million women, a country acknowledged for its unity in diversity, plurality of traditions, institutions and customs, India has always been proud of its women in every era. The 1991 census counted 407.1 million females against a male population of 439.33 million constituting just less than half (48.09%) of the total population of India (846.30 million). The sex-ratio as reported in 1991 was 927 females per thousand males¹.

India has a complex system of higher education. There are about 200 universities serving 4.3 million students. Statistics also reveal that the enrolment of women has increased almost 4 times since Independence. The enrolment of women students at the beginning of 1993–94 was 16.64 lakhs; and at the post-graduate level it was 35.1% of the total enrolment. Their performance levels have also been highly satisfactory¹.

The participation of women in technical and professional streams has also shown an increase, and there has been a noticeable growth in the number of women students in the engineering and technology streams in the IITs and polytechnics.

This trend is noticed in the participation of women scientists in the Extra Mural Research Programmes of CSIR also. The Extra Mural Research (Schemes) Programme of the Council of Scientific & Industrial Research (CSIR) provides financial assistance to promote research work in all the fields of Science & Technology, including Agriculture, Engineering and Medicine. The assistance is provided by way of grants to professors/experts in universities, IITs, post-graduate institutions, recognized R&D laboratories both in public and private sectors.

In 1990, fifty-two lady scientists and 3 emeritus scientists were awarded research schemes; in 1995 there were 55 lady scientists and 4 emeritus scientists. These scientists belong to different groups and are from all over the country. They represent life sciences, physical sciences, engineering sciences and chemical sciences.

An analysis of data pertaining to EMR schemes handled by women scientists for 1990 and 1995 reveals some interesting features. Two years' data has been taken for this as it was felt that comparison of data with a gap of 3–5 years might reflect the change that has occurred, *vis-a-vis* the EMR schemes taken by women scientists.

The emerging trends

A wide range of Institutes have had research schemes from CSIR. There are some which have been regular in sending schemes from lady researchers. Calcutta University tops the list followed closely by the Banaras Hindu University, the All India Institute of Medical Sciences and the Indian Institute of Science. That women scientists are being encouraged all over the country to participate in active research is apparent from the fact that schemes are being supported in such lesser-known institutes as Dunder College, Rajasthan, and Goa University, Goa.

Calcutta University deserves special mention. The women scientists of this university have not only been active researchers but have also shone in their sphere of research. There are 2 CSIR principal investigators who are Shanti Swarup Bhatnagar awardees and also fellows of the Indian National Science Academy. Another Shanti Swarup Bhatnagar Awardee to have a CSIR scheme is from the Indian Association for the Cultivation of Science. There are 2 FNAs from Garhwal University and the All India Institute of Medical Sciences respectively too.

Life sciences, that is medical sciences, plant and animal sciences has the largest number of schemes with

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Table 1. Trends in (first year's) research grant in schemes to women scientists in 1990 and 1995

Subject	Rs 10,000 to 25,000				Rs 25,000 to 50,000				> Rs 50,000				No. of research fellows			
	Cont.		Eqpt.		Cont.		Eqpt.		Cont.		Eqpt.		0-1		2 to 4	
	1990	1995	1990	1995	1990	1995	1990	1995	1990	1995	1990	1995	1990	1995	1990	1995
Chemical sciences	6	1 (-5)	1	2 (+1)	3	9 (+6)	1	5 (+4)	2 (+2)	1	1	6	11 (+5)	4	(-4)	
Physical sciences	1	(-1)		1 (+1)		5 (+5)				1	3 (+2)	1	5 (+4)			
Engineering sciences	1	(-1)								1	(-1)	1	(-1)			
Earth sciences					3	1 (-2)	1	(-1)			1 (+1)			3	1 (-2)	
Mathematical sciences		1 (+1)							1 (+1)		1 (+1)		1 (+1)		1 (+1)	
Medical sciences					2	(-2)		2 (+2)	1	6 (+5)	3	3	1	1	2	3 (-1)
Animal sciences	5	(-5)	1	1	14	4 (-10)	6	4 (-2)	8 (+8)	7	5 (-2)	14	9 (-5)	5	3 (-2)	
Plant sciences	7	(-7)	3	3	7	12 (+5)	4	7 (-3)	5 (+5)		2 (+2)	9	11 (+2)	5	6 (-1)	
Emeritus scientists	2	(-2)	1	(-1)	1	3 (+2)			1	1		3	4 (+1)			

(-) and (+) value indicate decrease and increase in trend respectively. Base year 1990.

women as principal investigators. Chemical sciences follow close behind. There were more schemes in physical sciences and even mathematical sciences in 1995 as compared to 1990. The same holds true for emeritus scientists also.

It has been suggested that irrespective of the level of education, boys have an advantage over girls in terms of access, retention and future use of their training². Moreover the education of girls continues to be influenced by a range of factors which are considerably different from those which affect boys' education. As the trend is moving from engineering subjects to life sciences with emphasis on hunger, disease and basic thirst for knowledge, women are pitching in strongly.

It has often been felt that girls are not given the same access to computers, microscopes and other essential tools as their male counterparts³. CSIR funding has been given adequately so that the goals can be achieved. One notices that with the increase in prices of chemicals especially biochemicals and enzymes which are necessary for life sciences, the level of funding has also increased. More researchers are getting funds between Rs 25,000 and Rs 50,000 or more for chemicals, consumables, etc. (Table 1). Chemical sciences have more contingency funding in the Rs 25,000 to Rs 50,000 category (+6) or even > Rs 50,000 category (+2) in 1995, as compared to 1990. Physical and engineering sciences also show a similar trend. But life sciences and mathematical sciences show an increase in contingency funding heading towards > Rs 50,000 (in the first year). Emeritus scientist contingent grants have now gone to the Rs 25,000 to Rs 50,000 (in first year) category. Similarly, equipment grants show that more schemes have been given equipment grants in 1995 as compared to 1990, though there are more in the Rs 25,000 to Rs 50,000 category than > Rs 50,000 (in first year) category. Since our mandate is Human Resource Development, our women researchers are also training future scientists and the number of

research fellows sanctioned in schemes have also increased.

Conclusion

The notion that women should stay at home and mind the children, while men are the bread winners is an old-fashioned idea³. Science and technology have liberated men as well as women from many erstwhile irksome tasks. Inertia, however, is as evident in societal changes as in Newton's laws of motion, and even today society frequently acts as if it can afford to underutilize the abilities of half of its citizens. Although many formal barriers to women's participation in science have fallen, cultural attitudes and antagonisms remain. Various socio-cultural factors and lack of requisite educational and other facilities to enable them to opt for education in these fields seem to account for the low participation of women in careers in engineering, science and technology, particularly when equal opportunities are provided by the governments in various forms. Social attitudes about girls' education are also responsible for the situation; parents mainly place a higher value on the education of their sons than their daughters.

Thus despite the changing gender roles, there are women who have accomplished the Herculean task of bringing up children and building reputations as successful scientists. As society searches for solutions for global problems in need of scientific output, we cannot afford to lose the potential of women's brain power. A biological clock that requires women to make decisions about a family in the same years that their commitments to research must be pronounced, makes pursuit of an academic career difficult indeed⁴. Many things can be done, and are being done with varying degrees of success to ease difficulties faced by women as they juxtapose a career in science with the wish to raise children.

To help its women fellows/associates, a period of absence up to 3 months on grounds of maternity with full stipend is given by CSIR. A relaxation in age limit up to 5 years for applying for these posts is also given to them. Also some travel concessions have been provided. It has also been generally agreed that in case of women scientists aspiring to return to science after fulfilling their family obligations, the condition of 'publication during the last five years' would not be insisted upon.

Despite changes in attitudes, society still places on the shoulders of women the major role in home building, and that combined with their biology means that the greatest domestic stress on women occurs in conjunction with the greatest scientific stress⁴. Child-bearing and rearing years coincide with the 'assistant professor' years. A special mention must be made of the emeritus scientists who have been the pioneers of the changing

scenario and have successfully sailed through all these, and are still active.

It is heartening to note that with all this, women researchers are still coming forward to ask for grants in a supposedly male-dominated society, as evident from the Table 1.

1. Fourth World Conference on Women, Beijing, 1995, Country Report, Govt. of India. Dept of Women and Child Development and Ministry of Human Resource Development.
2. Rajeswari, A. R., *Sci. Newsl.*, 1995, 11/12 June, 4-8.
3. Koshland, D. E., *Science*, 1994, 263, 1355.
4. Koshland, D. E., *Science*, 1993, 260, 275.

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Planning for science and technology and its relevance to national security*

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India is one of the few countries which has been observing remarkable restraint on military expenditure. In spite of that, the planners and managers of our economy brought us to the verge of bankruptcy.

AS an observer I have been deeply disturbed by the lack of understanding on this area vital to our national security and my approach to this theme is essentially as a strategic analyst. Though we have been boasting about availability of a vast reservoir of scientific manpower and we have a few achievements to our credit in agricultural production, nuclear energy, space and missile technology, yet considering the potential this country has, our achievements in science and technology lag far behind our expectations and capabilities. I was recently in South Korea and visited the Hyundai automobile factory. They started licensed production in 1967 and today they ranked tenth in the whole world in automobile technology and talk of billions of dollars of R&D investment and prototype developments from their indigenous R&D on electric cars and other advanced type of automobiles. In steel, electronics, communication

equipment and shipbuilding, they started a couple of decades after India in a country totally ravaged by war and yet today they are a global player. That set me thinking on this subject of relevance of science and technology to national security. When people talk of national security in India, especially those in the economic ministries, they think solely in terms of military security. Then they give a low priority to military security and argue that the country should focus on economic development since the real security is in economic development.

Today security has a much wider connotation than military security understood in the traditional sense. A nation must have economic security, food security, energy security, environmental security and political and social security. India is one of the few countries which has been observing remarkable restraint on military expenditure. In spite of that, the planners and managers of our economy brought us to the verge of bankruptcy in 1991. After four decades of economic planning, this country is still one of the poorest in the world in terms

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