(for example, a formal training in management) and (iii) experience as a leader in addition to the academic qualifications while choosing a head (or director). A careful decision while appointing heads of institutes can help in development of these institutes and also induce a professional approach in the academic sector and enable utilization of the resources in an orderly manner. Due to lack of administrative, financial and leadership skills, most of the heads are unable to take confident initiatives or bold decisions.

In my opinion, this move shall streamline the use of discrete powers given to an administrative head. Secondly, it may help create a transparent work system.

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Research productivity of female research scholars and their migration pattern in pursuit of higher education and research

Although women comprise about 49% population of India, they constitute only 15% of the total manpower engaged in R&D in science and technology (S&T)[1]. Over the years, women enrolment in science at graduation level has improved and the percentage of women earning doctorates in biological and chemical science is now close to 50%. However, the ratio of women scientists entering the workforce is still low[1]. The gross enrolment ratio (GER) for higher education is 13% in India as compared to 23.2% of the world. The GER for higher education in India for females is reported to be 11% as compared to 15.3% in case of males. Gender disparities in the net enrolment ratio (NER) have also been reported[2]. Though the enrolment of women in professional courses has steadily increased from 12.35% in 2004–05 to 18.45% in 2008–09 (ref. 3), the enrolment of women in science was stagnant at 19.98% in 2008–09 in contrast to 20.18% in 2004–05 (ref. 3).

Low GER for higher education, societal compulsions, gender biases and presumably low research productivity are considered to be the possible reasons for lower representation of women in S&T. An attempt has been made here to analyse the research productivity of female research scholars in terms of publications in *Science Citation Indexed* (*SCI*) journals in comparison to their male counterparts and their migration pattern in pursuit of higher education and research.

Data on the number of research papers published by female and male CSIR research scholars during tenure of the scholarship, institutions from where they acquired their highest degree, institutions they worked during doctoral and postdoctoral research, subject specialization, and journal(s) in which they published their research work were extracted from 998 records (358 female and 640 male) belonging to the period from 2004 to 2009.

Analysis has revealed that 26% of female research scholars (358) published their research findings both in *SCI* and non-*SCI* journals, 11% in non-*SCI* journals and 63% in *SCI* journals. In comparison to female research scholars, 28% of male research scholars (640) published both in *SCI* and non-*SCI* journals, 9% in non-*SCI* journals and 63% in *SCI* journals.

Analysis further showed that 48% of 320 female research scholars who published in *SCI* journals were from Life Sciences followed by Chemical Sciences (28%), Physical Sciences (18%), Earth and Environmental Sciences (4%), Mathematical Sciences and Engineering and Technology (2%). Whereas 37% of the total *SCI* research papers (900) published by female research scholars were from the Chemical Sciences followed by Life Sciences (33%), Physical Sciences (24%), and 3% each in Earth and Environmental Sciences, and Mathematical Sciences and Engineering and Technology.

Similarly, 37% of 581 male research scholars who published in *SCI* journals, were from Life Sciences followed by Chemical Sciences (34%), Physical Sciences (19%), Earth and Environmental Sciences (6%), and Mathematical Sciences and Engineering and Technology (4%). Whereas 39% of the total *SCI* research papers (1793) published by male research scholars were from Chemical Sciences followed by Life Sciences (29%), Physical Sciences (24%), Earth and Environmental Sciences (5%), and Mathematical Sciences and Engineering and Technology (3%). The correlation analysis between the number of female or male research scholars and *SCI* research papers published was fairly positive (1.0).

Subject-wise research output in terms of number of research papers published indicates that in the area of Chemical, and Physical Sciences, female research scholars published 3.7 and 3.7 *SCI* research papers/scholar, in comparison to 3.6 and 3.9 *SCI* research papers/scholar respectively by their male counterparts, whereas in the area of Earth and Environmental Sciences and Life Sciences, female researchers published 2.0 and 1.9 *SCI* research papers/scholar, compared to 2.4 and 2.4 *SCI* research papers/scholar respectively by male research scholars.

Research papers published in non-*SCI* journals indicate that in the area of Chemical and Physical Sciences, female research scholars published 1.7 and 1.8 non-*SCI* research papers/scholar, in comparison to 1.8 and 1.7 by male research scholars respectively, whereas in the area of Earth and Environmental Sciences and Life Sciences, female research scholars published 2.0 and 2.0 non-*SCI* research papers/scholar in comparison to 2.0 and 2.2 non-*SCI* research papers/scholar respectively, by male research scholars.

Data pertaining to female research scholars (320), who had at least one publication in *SCI* journals, showed that 71% were working in academic institutions including institutions of national importance and the remaining 29% were from R&D institutions.

Migration pattern of research scholars, who published in *SCI* journals, revealed that 65% female research scholars migrated from one institution to another compared to 62% of male research

scholars. Further, inter-state migration by female research scholars was 29% and inter-institutional migration within a state was 36%. Inter-state migration by male research scholars was found to be 30% and 32% for inter-institution migration within state. Further, it has been observed that 44% female research scholars from academic institutions migrated to R&D institutes in contrast to 38% of male research scholars. The migration pattern indicates that female research scholars do not have any hesitation in moving out of their home states in pursuit of higher education and research.

Although problems associated with the retention of women in science and engineering are well defined, each career progression results in lower retention of women than the stage before it, similar to a leaky pipeline[4]. The Department of Science and Technology (DST), Government of India has established a Task Force on Women in Science to augment women strength in science. The main purpose of the task force is to ensure that the interests of women in science are well-protected and promoted by the government and other organizations and suggest measures to motivate girls to take up S&T for higher education[1]. A special 'Women Scientists Scheme' has been evolved by DST for providing opportunities to women scientists and technologists who desire to return to mainstream science and work as bench-level scientists. Eighty per cent of the women availing the scheme were in the age group of 30–40 years, published over 651 research papers in *SCI* journals. Thirty per cent secured regular positions in institutions, 21% pursued higher degrees and 3% were employed in the industry[1]. It is hoped that such directed efforts will help in bridging the gender gap in manpower engaged in S&T.

Our study has shown that research publication output of female research scholars is at par with male research scholars and commensurate with their numerical strength in academic and R&D institutions and the dogma that Indian women have reservations about moving out from their family protection in pursuit of higher education and research is unfounded. Concerted efforts are however required to motivate and attract more number of students, and females in particular, for pursuing research in science and engineering including medicine and agriculture, for striking a balance in the socio-economic development of the country.

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The cranes' castle

It was five in the morning, dark everywhere, trees dancing rhythmically in unison in the background of dark sky and a hum of wind passing through the woods. We – two nature club members and myself – were making our moves cautiously so as not to disturb the wildlife and also for our own safety. We were in search of the Sarus Crane *Grus antigone*, a large elegant bird. And the place was the exclusion zone of Narora Atomic Power Station (NAPS) located about 140 km northeast of New Delhi. Surprised? Well, you may be, but yes, I am indeed talking about the exclusion zone of a nuclear power plant! This 1.6 km radius area around the nuclear power plant is indeed home to several birds, mammals, insects and flora–fauna. That is because it is tranquil and safe here, and this human-habitation-free area has an abundance of food and water bodies.

As we were wandering slowly inside the exclusion zone amidst the bushes and trees, we heard a fabulous sound, rather a pair of voices, from a little far distance. It was loud, high-pitched and trumpeting. Unmistakably, the sound was that of Sarus cranes. Full of joy, we started moving in the direction from where the voices were coming.

The sky started becoming pale and the dawn had broken when we reached near a freshwater lake. On the banks, there stood a pair of Sarus cranes, trumpeting in a rhythmic manner. The sight was simply amazing! They were strolling gracefully and making calls in between. A few metres away, in front of the pair, reposing on a bund was a juvenile crane, probably one year old. It was a family – a child with its parents – and the place was their home (Figure 1).

The sun was still below the horizon at twilight. The movement of the Sarus cranes in the background of mild orange-tinted sunrays and the cooling towers of the nuclear power plant, and their sublime song with the ambience sound of bird chirpings made the place very special.

With its courtly appearance, the Sarus Crane is a tall bird of about 150 cm, nearly the height of a human being. It is indeed the world's tallest flying bird. With its wings spread, it measures about 260 cm. Spotting the crane is pretty easy, as it is large and unique. The Sarus Crane

Figure 1. A family of Sarus cranes seen in the backdrop of the Narora Atomic Power Plant.