

Mapping the life trajectories of women scientists in India: successes and struggles

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This article discusses the findings of a research report titled 'Capturing diversity: a comprehensive report on women in science and engineering in India'. By mapping the life trajectories of 130 women scientists of India, the article highlights their successes and struggles at different levels of their lives in order to have a career in science.

Keywords: Child-care support, life trajectories, professional experiences, women scientists, work–life balance.

THE growing number of women in science and engineering in India reaffirms the faith in the potential of women to contribute to the knowledge domain of these niche disciplines. It also reasserts the place of women in these disciplines which not very long ago was predominantly a male bastion. Many of us who have followed the career trajectories of these women have observed that they are not homogenous, and it is the diversity that brings to fore interesting stories nestled in the socio-economic realities and cultural specificities of India.

This article is based on the findings of an exploratory research titled 'Capturing diversity: a comprehensive report on women in science and engineering in India', conducted by the National Institute of Advanced Studies (NIAS), Bengaluru, that maps the life journeys of 130 women scientists across different research institutions and universities of India (out of 130 participants, 111 (85%) had at least a doctorate degree while 19 (15%) were not doctorates and non-doctorates worked as technical staff. Also, 78 participants (60%) had at least one parent from a science background; 39 (23%) had parents from non-scientific background and 9 (7%) came from poor families with parents not having completed school education). Through an in-depth study of their life journeys, the present study intends to understand and celebrate diversity among women scientists in India. We used in-depth interviews based on a semi-structured questionnaire that focused on personal and family background of the participants. Since the study is aimed to understand the life journeys of these participants, the questions of the interview covered their family background, schooling experience, factors that influenced their career choice and their entry and experiences in their professional space.

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This article discusses the following three broad themes, namely: (i) Career choice, (ii) work–life balance and (iii) professional experiences.

Career choice

This study examined the relationship between studying science in school and making a career choice in science among the women scientists. Interestingly, studying science and pursuing a career in science are two totally different aspects for majority of women scientists. Unlike in the West, subjects that are taught in schools are common in India and students choose their subjects only after grade ten. As a young student, studying science in school is often not associated to one's intention of pursuing a career in science rather it is the simple pleasure of just studying science. It is strongly believed that students who excel in school should pursue a career in the Science, Technology, Engineering and Mathematics (STEM) disciplines. The promotion of science and engineering in India has a history and hence, the most visible and talked about career options are predominantly in the STEM disciplines. If one were to make a critical examination of the different programmes that identify talent at the school level in India, majority of the programmes will be in relation to the STEM disciplines; for example, National Talent Search, DST-INSPIRE, KVPY, etc. It is also believed that the status of a person employed in the STEM disciplines is far higher when compared to humanities and social sciences. This is coupled with the fact that STEM-related jobs have a better pay and better prospect for vertical career growth. Enrolment in the STEM disciplines till about two decades ago consisted of predominantly men. The last two decades have witnessed an increase of women in Science, Engineering and Technology, IT and Computer, Medical Science, Marine Science, Fisheries Science, Forensic Science, Veterinary and Animal Science-related disciplines in higher education¹.

Table 1. Gender distribution of undergraduate, postgraduate and Ph.D. enrolment in STEM disciplines in India (2010–19)

Year	Ph.D.		Postgraduate		Undergraduate	
	Female	Male	Female	Male	Female	Male
2010–11	33.78% (14,110)	66.22% (27,668)	41.78% (307,043)	58.22% (427,976)	37.27% (1,730,239)	62.73% (2,913,229)
2011–12	36.33% (15,193)	63.67% (26,631)	46.12% (394,359)	53.88% (460,849)	39.39% (2,408,474)	60.61% (3,705,426)
2012–13	37.20% (18,408)	62.80% (31,071)	46.78% (466,427)	53.22% (530,642)	39.37% (2,845,270)	60.63% (4,382,273)
2013–14	36.17% (21,442)	63.83% (37,851)	48.22% (544,357)	51.78% (584,750)	39.38% (3,405,805)	60.62% (5,243,741)
2014–15	36.86% (24,324)	63.14% (41,657)	50.12% (586,533)	49.88% (583,743)	39.64% (3,896,514)	60.36% (5,933,458)
2015–16	37.21% (27,430)	62.79% (46,273)	51.82% (593,931)	48.18% (552,117)	40.13% (4,103,094)	59.87% (6,122,515)
2016–17	39.12% (31,435)	60.88% (48,924)	53.39% (610,977)	46.61% (533,220)	40.94% (4,331,360)	59.06% (6,250,314)
2017–18	39.96% (38,490)	60.04% (57,809)	55.68% (901,117)	44.32% (717,424)	41.91% (4,494,337)	58.09% (6,228,718)
2018–19	40.81% (40,396)	59.19% (58,613)	56.11% (635,364)	43.89% (497,020)	43.28% (4,558,856)	56.72% (5,976,690)

Source: Data compiled from AISHE Annual Report¹, Ministry of Human Resource Development, Government of India. The actual numbers are given in parenthesis.

One of the main questions that we traced through this project was ‘how do women decide to choose science/engineering as a subject of study and ultimately make a career in it?’. The aim was to understand the determinants that attract and motivate women to choose STEM disciplines as their preferred subject. The existing literature, which draws its data mostly from the Western countries about women in STEM highlights that due to the lack of role models, there are not enough women in the STEM disciplines². However, unlike the Western countries, data from India suggest that the number of women in STEM disciplines at the undergraduate (UG) and postgraduate (PG) levels is equivalent to the number of men. Even at the Ph.D. level, women are not far behind¹. The problem however, is that even after completing the highest degree in the STEM disciplines, women are not visible in academia or research laboratories. They are conspicuously nearly absent in the prestigious national-level research institutions in the country³.

Through the data collected in this study, it is noticed that the family plays an important role in women’s educational and career choices in India. All the women scientists who participated in this study reported some sort of familial influence on their educational and career choices. Choosing a discipline for higher education and choosing a career in India are not individual decisions, but dependent on many social and cultural factors and the family as an institution plays a crucial role⁴. Families in India are closely tied by kinship where parents participate actively in such decision-making processes, even when a child has reached adulthood⁵.

The education level of family members plays a significant role. In this study, 117 out of the total 130 women scientists belonged to families with educated parents. The data revealed that having a parent employed in a science institution or industry gave the young child a natural role model that she observed in close quarters while growing up. Access to scientific network as well as subtle information about the culture of science gives girls from such families the natural advantage of entering the field of science. Out of 130 women scientists, an overwhelming

78 claimed to have parents with a science background which acted as an enabler to choose science as their career option. Science was not just a career option for them, but part of their lifestyle. Another important factor that played a major role in the decision-making process of these women scientists was the influence of their father. Almost 70% of the participants admitted about the influence of their fathers in their career choices.

Work-life balance

The study explored how women scientists in India achieve a work–life balance. Majority of the participants in the study (115 out of 130) were married. To capture the nuances of the work–life balance of married women, information about their daily routine and the related challenges was gathered. The aim was to understand how women strike a balance between their personal and professional lives, and the nature of support at home and the workplace.

Indian society represents a complex social fabric where societal and familial roles are ascribed by gender. Men are the main breadwinners of the family, while women are considered as caregivers in the role of a wife and/or a mother⁶. However, this attitude is changing as women are no longer willing to be confined to their homes and are joining the workforce in large numbers by choice⁷. However, the choice of becoming a working woman does not automatically liberate them from the traditional prescribed gender roles. Research suggests that women are redefining these roles to enable them to be successful at work and a shift in the familial setting is clearly visible⁸. This change in the dynamics of the family structure and gender roles is among the important factors that contribute to women being able to balance their professional and personal lives. The change in gender roles is predominantly more visible in the Indian cities among middle- and upper middle-class families. However, this is not true for all families within these classes and women struggle to mediate the gender roles in their families.

One of the most important factors that enable women to manage their personal and professional lives is having a supportive husband⁹. All married women scientists who were interviewed as part of this research emphasized the importance of having a supportive husband for a better work–life balance. As young brides, women initially struggle to negotiate to continue their studies after marriage in their marital homes. Here the support of the husband is critical. It is observed that younger men, who are married, now request their work institutions to enable a better work–life balance so that they can participate actively in the child-rearing process and share the household responsibilities¹⁰. Despite this positive shift, women still remain the prime caregivers of a family. Women are still expected to sacrifice their careers for the good of their families when the need arises^{11,12}. The extension from passive to active support from husbands makes it easy for married women to have a balance between their personal and professional lives. Apart from having a supportive husband, women also need a good childcare support system for a better work–life balance.

The literature argues how the institutional childcare support system is crucial for women to have a career^{13–15}. The demand for a good institutional childcare support system stems from the fact that it positively impacts the productivity of women professionals. The emphasis is on developing better state-sponsored childcare support systems and how the existing ones need to be perfected^{13–15}. This is true in the case of the Western countries, where they have an elaborate and advanced institutional childcare support system. In India, the nature of the childcare support system is far from efficient. The state-funded institutional childcare support systems are in their infancy, and those which exist are in such poor conditions that women hesitate to leave their children there¹⁶. One of the reasons for the lack of the proper state-supported childcare systems in India is that till recently, the joint family and extended family systems were predominant in the country. In India, childcare is not considered the responsibility of the parents alone. One of the major childcare support systems in India is the extended family. However, with the increased employment opportunities in geographical locations away from their marital homes, couples struggle to find childcare support systems in their new locations. In the absence of state-supported childcare facilities and inadequate facilities at the work place, women professionals depend on their families for childcare. Even though the structure of families in India is fast-changing, the role of grandparents remains pivotal in child-rearing. The families that earlier disapproved of educating girl children have now moved in with their employed children to help them raise their kids¹⁷. This system helps working women professionals as they prefer to leave their children with their grandparents.

During the growing years of their children, women professionals use multiple support systems involving their

parents, extended family, childcare professionals as well as childcare facilities near their home or workplace. What we need to understand is that women in India create their own support systems, which are a combination of various support structures like supportive husbands, extended family members, hired child care help, etc. Unlike in the West, women in India rely on and create multiple support systems and navigate through them for a better work–life balance. These support systems are personalized and private in nature, and this necessitates having a privileged position. Unfortunately, not all women scientists have the resources for multiple support structures. Very often, the absence of childcare support becomes the primary reason for women scientists to quit or take a career break.

The responsibility of the institutions to provide childcare support was raised by women scientists, as such an arrangement will help enhance their productivity¹⁸. Not having an efficient institutional childcare support system makes childcare a personal matter that women are supposed to deal with using their own methods. In the process, the scientific institutions not only fail to acknowledge the needs of women scientists but also reinforce gender norms, which, as a result, makes difficult for women to survive in the system that automatically favours men.

Professional experiences

The third aspect discussed here is the working experience of women scientists in scientific institutions. To map this, we asked women scientists about their experiences of working in a particular institution, with a focus on recruitment and promotion processes. The University Grants Commission (UGC) recently issued a notice mentioning that Ph.D.-degree holders from top foreign universities are eligible for direct recruitment as assistant professors (<https://www.indiatoday.in/education-today/news/story/phd-holders-from-top-foreign-varsities-are-now-eligible-for-direct-recruitment-as-assistant-professors-says-ugc-1398533-2018-11-29>). Although this seems like a new rule, the practice of hiring a foreign university degree holder was common practice, particularly among high-ranking research institutions and universities in India¹⁹. Eighty per cent of the women in the study reported the importance of experiences abroad as critical to the hiring process.

In India, women's safety is linked with family honour and hence families restrict their mobility. Travelling abroad for higher education is not even an option for most women who face multiple challenges at every stage of their lives to complete their education²⁰. The age of marriage for women often coincides with the period of doctoral/postdoctoral studies and hence, women who are unable to travel abroad during this period are at a disadvantage.

Another issue that some women scientists faced was the lack of transparency with regard to the specific requirements

for a faculty/research position. They reported that while the advertisement mentioned the requirements for a particular position, there were often additional unstated requirements necessary to be a successful candidate. Male applicants often get access to this information through their networks giving them an advantage over women^{21,22}. Additionally, women are given token representation in various selection committees. The few women who are part of this elite group often believe that like many of them, young women scientists need to find their own way. The absence of early mentoring is a serious lacuna for many young women scientists. Accessing scientific network through family and friends becomes critical to get the initial breakthrough and provides early mentoring to build a career in science²³. Many women scientists mentioned that they did not hear from the institutions about why they were not hired. This information gap works to the disadvantage of women. The biases that operate in the interview process are protected under the guise of confidentiality. Since women are fewer in number and have comparatively less experience than men as selection committee members, they will need to develop strategies to execute their role effectively.

The process of promotion is equally non-transparent. The selection process differs across institutions and the rules for promotion change frequently placing the small number of women at a disadvantage. Most women perceive themselves as falling short of the required credentials to apply for promotion. Among those women who apply and are denied promotion, they are often unaware of the reasons for their failure. When they were able to access the reasons for their failure, they were informed that ‘sometimes it is about seniority’ or ‘sometimes it is about the quantum or quality of the research work’. The mismatch of the criteria for promotion and distribution of responsibilities by gender often tends to place women at a disadvantage. Some women also reported that ‘the points system’ to judge one’s progress is not ideal because it does not consider all the extra time and effort a faculty member devotes in relation to administrative and teaching responsibilities. Further, family responsibilities restrict the participation of women in conferences and informal networking, which is critical for raising grants and resulting in research publications (21 (around 16%) out of 130 participants talked openly about how, as women, they were not part of many informal circles which is important for career growth. Most of the participants had made peace with it and accepted that workings of the system, put women at a disadvantage).

Conclusion

While India has made progress in terms of enrolment of women in the STEM disciplines, the present study highlights the challenges that Indian women scientists and

engineers face. The relationship between excellence in academics and STEM disciplines is reiterated by the family, school and society at large. The role of families, particularly the fathers, in making career choices for girls is predominant in India. There are few exceptions where the mothers, in some cases with limited formal education, have supported their daughters to pursue a career in science. Hence it is no surprise that science and engineering in India have attracted talent and continue to be an aspiring profession for most girls. While newer opportunities in commerce, law and management open up for students in cities, science and engineering continue to be the more sought-after professions for children from small towns and villages in India. For a vast majority of women scientists who come from traditional households and are part of small towns and villages (around 60%), the challenges of balancing home and work are part of their everyday struggle (78 out of 130 participants were from small towns and talked about the difficulties of coming from traditional households; 29 of them work at universities in small towns). The study discloses that family background, geographical location, schooling experience, and work environment vary among the women scientists in India creating the diversity of women in STEM in India. These diversities in turn reflect the nuanced ways in which each of these women negotiate their rights as they advance in their careers and manage their families.

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