

Understanding the Facets of a Conducive Environment in Encouraging Women Researchers

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DOI: - <https://doi.org/10.47531/MANTECH.2021.03>

Abstract

Several interplaying aspects create an environment that readily encourages women to gain an interest in research at an early age and subsequently pursue it as a career. Insight into these individual facets can unravel the factors behind establishing the ideal research ecosystem for women researchers. In this paper, we try to understand these driving factors that can help women who are planning to or are already pursuing a research career. Thus, personal and collective efforts to build a conducive environment could pave the way for women to reach their potential, thereby inspiring future researchers.

Keywords- *Women, Research, Environment, Driving factors*

INTRODUCTION

Women have conventionally been administering the restricted roles of caregivers and nurturers in a family, and this is especially palpable in the Indian context. With the males in the family considered to be the sole breadwinners, the participation of women in the labour force has been far from prominent. India is deemed as one of the fastest-growing economies in the world, and the per capita gross domestic product (GDP) has seen dramatic changes. However, the contribution of women to the national GDP was a mere 23.4% in 2019 [1]. As the nation makes strides in women's development and progress, the lingering growth paints an alarming picture.

EDUCATION AND ECONOMY

The stance of education in the economic development of a nation is well understood and is

aptly considered while tracking and devising goals for the progress of a nation. As noted by Ozturk [2], education is a driving force of social and economic progress.

The impact of investing in education was understood post 19th century with the application of science and technological principles in industrial production. This gave way to an improved understanding of the significance of education.

Since workers with education can execute tasks with critical thinking and a better understanding, owing to the knowledge and training imparted, this improves efficiency. This increased productivity, in turn, contributes to the country's economy.

Wilkinson and Pickett [3] illustrated the correlation between high educational scores and income inequality across nations. Mathematical

and literacy scores were measured in 15 year-old male and female students across different nations, and these were observed to be higher in countries with low-income inequality, such as Japan and Finland.

With the implications of education in a nation's economy being duly understood, one of the sector's offshoots, i.e., female education, is receiving its deserved importance.

Female education has now been realized to be a paramount investment for any developing nation. Dr. James Aggrey, the renowned educator, who impacted the African and African American education systems, rightly said, "If you educate a man, you simply educate an individual, but if you educate a woman, you educate a family."

We have had similar reformers in India, such as Jyotirao Phule and Savitribai Phule, who pioneered female education before Indian independence. The nineteenth-century further saw the likes of Raja Ram Mohan Roy and John Elliot

Drinkwater Bethune, among many others, who advocated for the education of girls to build a stronger nation.

Ever since, the female literacy rates in India [4] have seen significant improvements, as shown in Fig. 1a, this is the consequence of years of efforts undertaken by society, individuals, and the Government of India. With the nation's development goals and programmes and societal perception changes emphasizing girl education, we are slowly inching towards gender equality.

However, the increase in female education does not correlate with women's participation in the workforce [5] and is shown in Fig. 1b. This dip in female labour participation in recent years is a matter of concern, and it is attributed to factors such as occupational segregation and women employment in low-productivity sectors, automation of machinery, and perception of women's financial contribution as only secondary, lack of familial and institutional support.

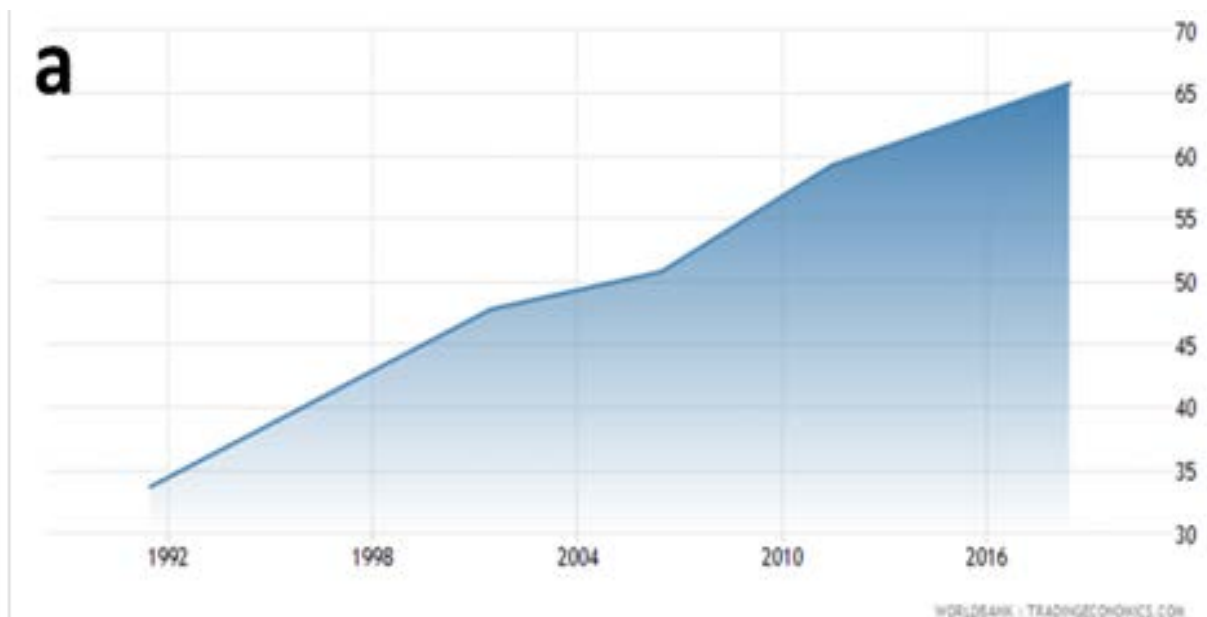


Fig. 1 (a) Female literacy rate for ages 15 and above (displayed as percentages) [4]

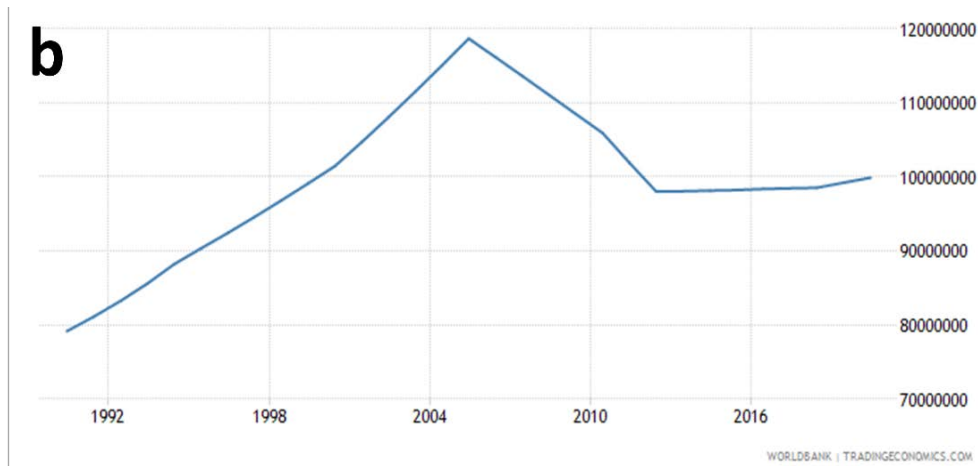


Fig. 1 (b) Female participation in the labour force [5]. The data is obtained from the World Bank.

(Source: tradingeconomics.com)

EDUCATION, ECONOMY AND RESEARCH

The process of education, which can be tracked with the mental and intellectual growth of a child, involves a lot more than gaining knowledge. Dr. Aggrey, who was an ardent advocate of education, underscored the role of university education on how it should encourage original thinking and research, ultimately adding to human knowledge.

Interestingly, the word ‘Education’ stems from the Latin words educare, which refers to bringing up or rearing; educere, which means drawing out, from e- (meaning from or out of) and Duco (meaning ‘to lead’). Hence, education refers to the process of not just gaining knowledge, but most importantly, of inculcating skills and attitudes.

The role of an educator in ‘bringing out’ ideas from a child, prompting him/her to do the thinking, is understandable. This process of ‘original thinking’ brings us closer to the idea of research. The gap between education and research lets fewer students get introduced early to research early. Hence, educators have been seeking to bridge this gap between education and research.

The impacts of research and development (R&D) inputs by a country on the GDP are ample, particularly on innovation, improved productivity, employment, exports, and increased capital. This calls for adequate GDP expenditure by the Government for R&D activities. For the case of India, stagnant growth in gross GDP expenditure on research and development has been observed.

The gross domestic spending on R&D for the two-decade period 1996-2016 [6], in terms of percentages, is shown in Fig. 2. The research sectors included are business enterprises, Government-related R&D, higher education, and private non-profit organizations, and the R&D activities comprise of basic, applied, and experimental research.

The contribution and participation of women in the Indian R&D scenario are receiving increased recognition and the due acknowledgement deserved. The role of women in the research ecosystem, although undervalued, has been understood to be impactful and indispensable for the balanced growth and development of a nation.

With an appreciable increase in the number of women interested and employed in research organizations, including those in higher positions, and with an increase in scientific publications by women authors, more number of women enrolled in a Ph.D. programme or receiving post-doctoral fellowships, the future appears promising. See figure- 2.

Furthermore, the participation of women in extramural research and development projects has increased from 13% in 2000-01 to 24% in 2016-17, according to a report by NSTMIS, Department of Science and Technology. The number of women employed, as on 1st April 2018, was recorded to be 16.6% of the total personnel [7]. This increase in the involvement of women in the world of research is highly reassuring and can be attributed to several factors, including initiatives by the Government and other facilitating factors encouraging women to take up research, both academically and post-academically.

It also becomes imperative to examine the other side of the story, i.e., the factors that demotivate

women from considering research as a prospective career, leading us to understand why there are not as many women in research as expected. In this paper, we try to comprehend the factors that enable women to gain interest in research at an early age, and subsequently, pursue it as a career. Since many aspects are at play, including the role of families, peers, educational institutions, and society, understanding the individual facets would help in encouraging the next generation of women researchers.

A HYPOTHETICAL SCENARIO

Consider a hypothetical scenario involving two 10-year-old girls-**A** and **B**, belonging to the same city. **A** grows in an affluent and highly educated family, with her scientist parents who strongly believe in gender equality. They push **A** to think for herself, encourage her to ask questions, and as a result, she has access to the best of education, technologies, games, and tools, which further encourage her to learn with like-minded peers. **B**, although equally inquisitive and intelligent, on the other hand, belongs to a family on the lower rung of the economic ladder.

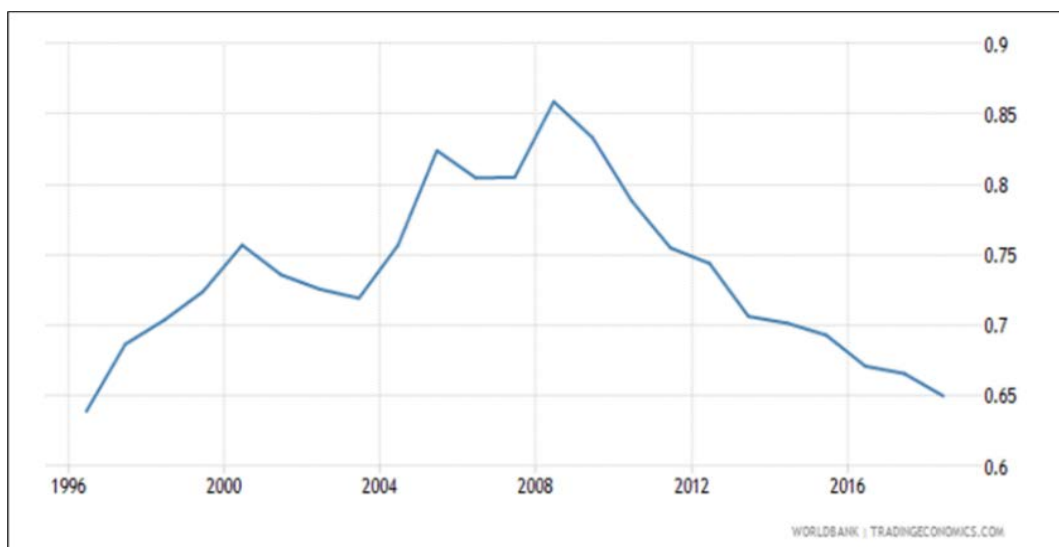


Fig. 2: India's Research and Development expenditure expressed as a percent of GDP [6]

(Source: <https://tradingeconomics.com>)

With parents who consider girl children as ‘leased until married off’ and have little time and knowledge to cater to **B**’s learning needs, **B**’s interest in research gets stifled. The educational institutions that **B** attends do little to inculcate interest and original thinking in the students. Over time, **B** succumbs to mediocrity and gives up her dream of becoming a researcher.

It is safe to presume and predict how **A** and **B** would have fared 10-12 years down the line, provided that the situation surrounding them remained constant. While **A**, who was exposed to the nuances of thinking and to research options during her prime years by her well-informed parents, would be more open to pursuing research as a career, it is difficult to lay down the same aspirations for **B**, although not improbable! The availability and accessibility of merit-based scholarships and financial assistance, awareness of research opportunities, support from a family member, or motivation and guidance from a teacher –this can make a world of difference for **B**’s research prospects.

The traits of curiosity, a questioning mind, and exploration are innate to a child, and these innate tendencies combined with cultivated traits such as open-mindedness, passion, and persistence, and developed skills, form the basis of a research mindset. In the above hypothetical scenario, **A** seems to be on the favourable end of developing a research mindset, as against **B**. As previously mentioned, this is subject to inertial constraints, and it lays down the possible facets that motivate/demotivate young girls to higher education, and gradually to adopt the research mindset.

INTERPLAYING FACETS IN ENCOURAGING YOUNG GIRLS/WOMEN TO PURSUE RESEARCH

Some of the driving factors which facilitate and encourage young girls/women to pursue research, either academically or as a career, can be gathered from real-life instances. These are illustrated in Fig. 3.

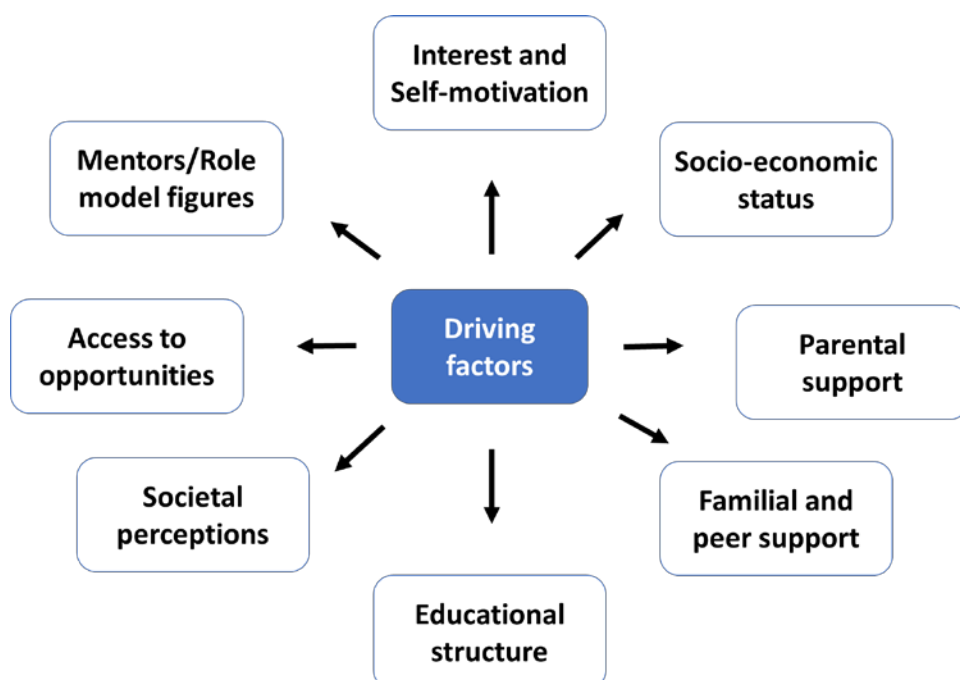


Fig. 3: Some driving factors which are at play in encouraging girls/women to pursue research

Some such facets can be observed from the real-life accounts of Indian women scientists. The book 'Lilavati's daughters: The Women Scientists of India,' published by the Indian Academy of Sciences [8], contains a compilation of autobiographies and biographies of about a hundred women scientists in India. These scientists range across various time spans and geographies, but a common theme can be deciphered. In an age where women were not considered to be partakers of research or even higher education, accounts of women who braved the societal pressures and perceptions, are a source of inspiration for the younger women researchers. Furthermore, the common theme still holds true for the current generations. Some of these interplaying facets are discussed below.

Familial Structure- Parental Support and Socio-Economic Status

One of the major driving factors that facilitate women to pursue research is the family background. The support offered by the parents, which also takes into account the education and/or interest levels of the parents, play a major role in instilling confidence and piquing interest in the minds of young girls. This is especially observed when parents are well-informed and actively involved in the education of their children (especially daughters), irrespective of their education levels.

While this support is inherent in some families where the parents or guardians are monumental in instilling confidence and interest sans gender bias, the situation is detrimental when parental support is scanty or absent. In such cases, factors such as self-confidence or the presence of a mentor or influential role models can play a vital role.

It is quite understandable that the earliest conditioning of a young's researcher's mind begins at her home, and some factors can facilitate a fair and conducive learning environment. These include- ensuring a gender bias-free, broad-minded and liberal upbringing, equal educational opportunities to sons and daughters alike, encouraging and involving their children in the learning process, imparting independent thinking, and encouraging curiosity, problem-solving, and providing a platform to ask questions and seek the answers systematically. Besides, when the importance of educating a girl is understood, efforts should be taken by the families in providing the necessities of education, financially and by building a fair learning environment at home.

Furthermore, aspects such as the familial background, socio-economic structure, influence of siblings, relatives, and peers, and encouragement, or often discouragement from others, have an impact on women while she considers research as a prospect. When it comes to questions of marriage, the familiar environment plays a very important role. Key decisions such as whether or not to marry whom and when to marry, it require ample support and understanding from the parents' side. Considering that a woman decides to pursue/continue research post-marriage, other factors come into play, such as early family responsibilities, support of husband and in-laws, and the challenges of child-rearing. A young married woman researcher who is backed by a strong support system can realize her full potential and be an inspiration for the younger generations.

Institutional Structure

Formal education plays an important role in the development and transformation of a young

individual. As Darling-Hammond *et al.*, note in their study [9], the science of learning and development principles take into account social and emotional development, provision of a supportive environment, building a system of supports, and provision of instructional strategies towards building motivation, competence, and self-directed learning., which together contribute to the all-round development of a child. A solid foundational development, hence, is key to sowing the seeds of the academic, physical, social, emotional, cognitive, psychological, and ethical development of a child. This is where the school and college environments interject.

The presence of dedicated and influential teachers is a very crucial factor, in addition to other aspects of institutional systems, including infrastructure and lab facilities. The former cannot be undermined, since it has been observed that teachers who extend faith in the abilities of the students, especially young girls, instill confidence and can also be influential in persuading the parents to encourage their daughters to pursue research. Thus, a highly charged gender bias-free schooling environment, with equality in the access to opportunities to both girls and boys, should be the basis for any conducive environment for encouraging young girls to study further, and in the process, get acquainted with the idea of a research mindset.

In the context of college and university level education, the number of girls enrolled in higher education has drastically increased. In the 9th All India Survey on Higher Education (AISHE) [10] for the year 2018-19, 48.6% of females were reported to be enrolled in higher education institutes as against the 44% in 2010-11. It is also

interesting to note that more women are enrolling in post-graduation courses with time. However, the common observation is that women confine their higher education to traditional courses such as masters' in arts, commerce, nursing, library sciences, architecture, fashion management, or hospital administration, although the scenario is changing. Another disheartening observation is that, despite enrolment in higher education, the actual number of women (although competent and passionate), who pursue a research career is very low. The underrepresentation of women in research organizations, especially at higher positions, is one such implication.

In this regard, there needs to be a paradigm shift in the institutional structure, expanding the vision of career options for young women, and that requires path breaking mentalities, and most importantly, a change in the societal perception. Availability of opportunities and encouragement to participation should also work in tandem with the Government and other support institutions to achieve such a nurturing support system.

Mentors and Role Models

The presence of role models, especially within the family, is instrumental in motivating young women in all spheres of life, and this is particularly relevant for the research context. Also, teachers who make learning interesting enough for young students have a role in motivating them to consider pursuing those areas of study.

Mentoring has also been found to be effective for women returning to their research pursuits after a break. Empathetic support, extended by peers or others, and guiding them based on prior experiences, can positively impact women to realize their full potential.

Perceptions -Societal and Self

The societal perceptions of women largely restrict their lives to adopt stereotypical feminine roles. Although this has seen a sea of change over the last few decades, especially in the idea of educating girls, deeply rooted conceptions of people can still influence lives. Stereotypical beliefs impact all spheres of life- the upbringing of girls, their learning environment, careers, and family lives, wherein the society frequently controls the thought and decision-making processes. Thus, when women blindly adopt such imposed beliefs, it handicaps their growth. Although the societal perception of women has seen gradual changes over time, the under-representation of women in most fields (education and career-wise) portrays something contrary.

Girls are encouraged in schooling, and this is optimistic; however, they are expected to push higher education and career to the backseat and wholly adapt to the roles offered post marriage.

Societal perception and the concept of self-perception are closely related. *Ehrt et al.* [11], in their study, observed how stereotypes largely drive self-concept. The societal belief that ‘certain domains, such as science, technology, engineering, and math (STEM) should be restricted to males, and women are less competent’ negatively impacts self-perceptions.

A study by Forbes [12] consisting of students aged 15-16, showed that girls are less likely to consider the STEM subjects as their best subjects, although they are known to outperform boys in both STEM and non-STEM subjects. This is not due to the absence of abilities, which is clearly proved otherwise, but because of them lacking confidence

in their abilities, and this can be majorly attributed to stereotypes surrounding STEM.

Thus, it is the hands of the stakeholders - the teachers and parents, to dispel misconceptions and stereotypes and encourage and motivate the future young researchers to have a healthy self-perception, admitting to the truth that she is as good as any other male student, and is capable of impacting the society through her life, education, career, and research.

ENCOURAGING WOMEN TO THRIVE AND FLOURISH IN THE RESEARCH ECOSYSTEM

Challenges are inevitable in a research career for anyone, more so for a woman. The common challenges reported by women researchers vary in degree and propensity. Some of these include:

- gender-based discrimination and politics at organizations due to patriarchal mindsets
- unequal opportunities available to women
- sexual and emotional harassment at workplaces
- safety concerns, especially pertaining to field jobs
- the pressure to prove herself and make her voice heard in a male-dominated ecosystem
- societal perceptions of women, compelling her to focus solely on family, rather than her career
- lack of support from family, resulting in stifled interests
- the pressure to get married due to the stereotypical notions of age, society and the ‘marriage is the ultimate goal’ mantra imposed on women, leading to loss of focus, self-doubts and reduced productivity

- break in career due to marriage or childbirth, and when people start questioning their commitment and abilities
- having to prioritize husband's career over her own, leading to relocation, or even quitting
- family responsibilities, sacrifices, and stress involved in achieving a 'perfect' work-family balance, often resulting in guilt
- lack of organizational support, in terms of maternity benefits and childcare facilities
- lack of recognition of abilities, talents, and achievements
- lack of awareness about opportunities pertaining to research
- facing distrust from collaborators
- imposed and inherent lack of confidence and guilt, sometimes resulting from stereotypical notions
- reluctance to network and collaborate
- conflicts between women themselves – competition rather than mutual support
- lack of good mentors or friends to help and guide through challenging times

Thus, for women researchers to thrive and flourish in the cut-throat, competitive research ecosystem, and in order for her to contribute confidently, several steps need to be taken at all levels. Some such suggestions to create an ambient environment for encouraging women researchers to establish themselves are observed and compiled here.

More Focused Initiatives from the Government and Awareness

There are several initiatives in place from the Government of India to encourage women researchers, by awarding and recognizing their contributions, providing grants and fellowships for Ph.D. programmes, postdoctoral fellowships, and

intramural projects, especially from the Department of Science and Technology (DST) and Department of Biotechnology (DBT). There are also programmes in place to bring back women to pursue research after career breaks. Such schemes need to be scaled up, and the information of such systemic interventions should be made easily accessible and available.

Organizational Support

The research organizations need to focus on creating an environment with gender-balanced recruitments, a bias-free conducive environment for women, adequate maternity benefits, flexibility, and childcare facilities.

Peer Support - Networking, Branching out and Collaboration, Mentoring

The establishment of forums at school, university, and organizational levels to discuss issues faced by women in all stages of their research pursuit could help build a supportive unit. Mentorship programmes need to be encouraged so that women in their early career stages can reach out to others and seek guidance. Such connections build trust, allows voicing of opinions, encourage women to branch out, gain confidence, and build strong collaborations, working towards the common good.

Educating the Public

When the public is encouraged to realize and understand the impact of women researchers in various spheres of life by duly acknowledging them, this could give them a chance to revise their stereotypical beliefs. Sharing encouraging stories and achievements of women researchers, and researchers in general, who have fought for their place in the society and made notable contributions through their research, can help

educate the public. From warding off traditional fears associated with a research career, and spreading awareness about what a research job entails, it is important to spread awareness among people. That despite the snail's pace, fruitful research has the power to change the world; this is one message that needs to be heard. This is crucial for the realization of an equal and healthy world to become conducive for the researchers to learn, grow, and flourish.

Creating a Healthy Family Support System

The role of a familial environment in encouraging women researchers was discussed in Section 3.1. Families should be encouraged to respect the decisions made by women without imposing their ideas. Empathetic understanding is integral from the family side, especially about the demands of the research career, the flexibility, and rigidity that go hand in hand with any research, and valuing her time as much as theirs.

Contribution from husbands in household responsibilities and in raising children would reduce the burden often solely borne by women, thus, enabling her to focus on a progressive work-life environment and hence enhance the research ecosystem.

Making all efforts to build herself

It is ultimately in the hands of the women to take ownership of their lives and research careers. It is thus expected of every woman researcher to make use of every opportunity available to develop herself, i.e., build her self-confidence, skills, and abilities. This could also pave the way for younger women to follow.

CONCLUSION

The role played by women in different spheres of life, especially the contributions made by several women researchers, cannot be underplayed. Several interplaying facets lead to women realizing her importance and rightful place in the world of research. With a healthy self-perception, interest, and passion in the area of research, topped with determination and diligence, a woman can excel at her research, and these factors equally apply to a man. Introspection and discussion of these facets can thus help in inspiring women to pursue, thrive, and flourish in research.

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