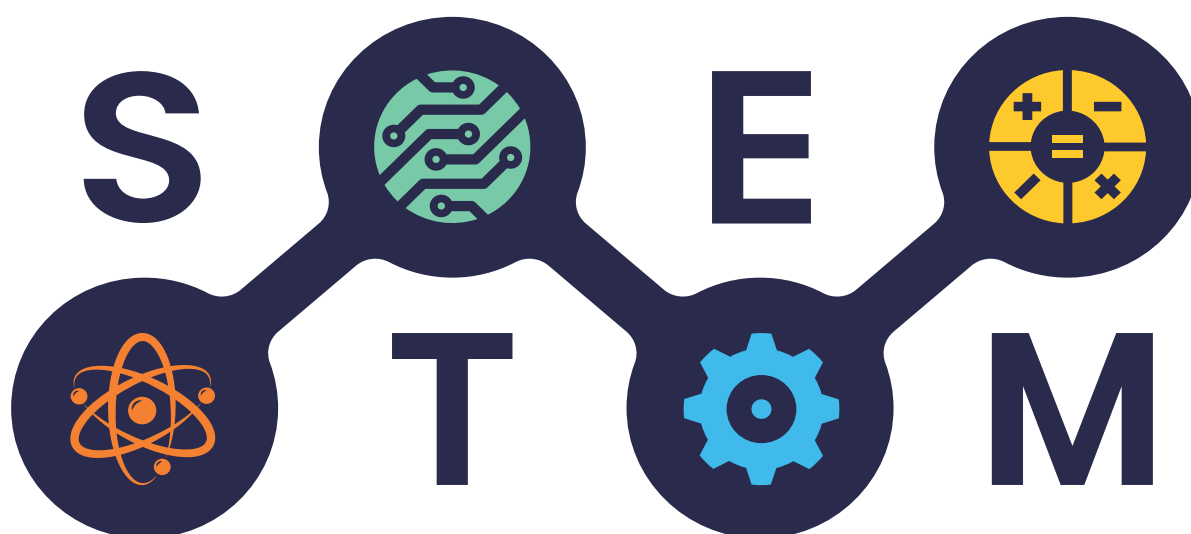




Confederation of Indian Industry

REPORT ON

WOMEN IN STEM



SCIENCE - TECHNOLOGY - ENGINEERING - MATHEMATICS

CURRENT TRENDS, CHALLENGES, RECOMMENDATIONS, CALL TO ACTION

JANUARY 2023

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Foreword



Mr Vipin Sondhi

Chairman, CII National Mission on Technology, Innovation, and Research.

Science, Technology, Engineering and Mathematics (STEM) are critical to the national economy and future development. Even though the higher presence of women in STEM offers a significant opportunity to boost innovation and inclusive growth, there are long-standing gender gaps in STEM in organisations that makes it difficult to fulfil the commitment of diverse hiring practices.

Therefore, it is important to understand the status of women in STEM, especially in the Indian context, the trends related to their participation, challenges, and barriers; as well as map and learn from the best practices across the globe, and then take corrective measures, to bridge the gender diversity gaps.

With this in view, CII formed a task force on Women in STEM under the aegis of CII National Mission on Technology, Innovation and Research. The purpose of the Nationals mission is to make India a technology leader driven by a focus on innovation and research. The mission has five key goals including, enhancing national investment in R&D with a specific focus on encouraging industry contribution; nurturing Innovation competitiveness; fostering collaboration among industry-academia-research labs-startups and finally enhancing gender equality in STEM workforce to a minimum of 50 percent by 2047, with an interim milestone of 35 percent by 2030. To take forward the Women in STEM goal, the task force led by eminent leaders from the industry, academia and entrepreneurs have worked upon in bringing out this comprehensive Thought Leadership Report on Women in STEM. The report highlights the need, showcases some of the best practices, emphasized the gap areas and provides some specific recommendations for enabling the stronger gender equality in STEM workforce.

I would like to sincerely thank all the members of the task force for bringing out their expertise and experience for bringing out this report which is a subject of immense national importance. It is expected to be a thought-provoking document for all the stakeholders to understand and contribute in this mission of promoting women in STEM.

Foreword



Mr Alok Nanda

Co-Chair, CII National Mission on Technology, Innovation, & Research

Science, Technology, Engineering and Mathematics (STEM) is a thriving field, however the number of women in STEM is not nearly balanced in the workforce today. Women make up only 28% of the workforce in science, technology, engineering, and maths (STEM). The gender gaps are particularly high in some of the fastest-growing and highest-paid jobs of the future, like computer science and engineering.

With this in view, there is a strong need for the industry to scale up their commitment & efforts to build a more diverse workforce. It brings forth wide-ranging ideas and perspectives that enrich and expand knowledge and science in all its facets. While there has been progress in the number of women in STEM, a lot more is required to truly unlock potential in innovation and problem solving to build the future of science & technology.

Taking forward the agenda of encouraging Women in STEM, CII is working on this as a mission to enhance gender equality in STEM workforce to a minimum of 50% by 2047, with an interim milestone of 35% by 2030.

Under the aegis of CII National Mission on Technology, Innovation and Research, CII has worked on the present report which provides a detailed overview of the status of Women in STEM in India as well as suggests several recommendations to encourage the promotion of women in STEM.

I am sure this report will serve as a good reference point for taking forward the mission of promoting Women in STEM as a movement across the nation. My sincere thanks to the members who have contributed towards the development of this report on women in STEM.

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Acknowledgement

Women play a pivotal role in nation building and inspiring a whole new generation. As science, technology, engineering, and mathematics are becoming greatest enablers in help addressing a gamut of challenges, the need for women's participation in them has now become more relevant than ever. Thanks to the holistic effort of the government, corporates, and academia for running financial and infrastructural initiatives to encourage women representation in STEM, it is heartening to see India raising the benchmarks. However, to make deeper impact and greater outcomes, we, as a nation, still need to work more in the key areas of growth, challenges, and prospects.

CII has brought together a team of eminent researchers and practitioners who have been deeply engaged with women in STEM. This landmark report, as an outcome of a quarter-long study provides a wide spectrum of insights. It is our sincere endeavor to envision a better tomorrow powered by an inclusive workforce, and hope that the recommendations will be duly considered for inclusion in the national policies starting 2023-24.

On behalf of the CII National Mission for Technology, Innovation and Research, I would like to acknowledge and express my gratitude to the following for their contributions:

- Dr. Anju G Parvathy, Asst Vice President – Research and Solutions, Avtar Group
- Dr. Anuradda Ganesh, Chief Technical Advisor and Director, Cummins Technologies
- Ms. Divya Arya, Deputy Director, Confederation of Indian Industry
- Dr. Hima Elizabeth Mathew, Senior Manager - Research and Solutions, Avtar
- Ms. Jessy Allan, Marketing Leader, Cisco Systems
- Dr. Manashi Adhikary, Head Failure Analysis and Plant Metallurgical, Scientific Services, Technology and New Materials Division, TATA Steel
- Ms. Namita Bahl, Director, Confederation of Indian Industry

- Dr. Nimita Pandey, Assistant Professor, School of Social and Behavioral Sciences, Amrita Vishwa Vidyapeetham
- Dr. Saundarya Rajesh, Founder & President, Avtar Group
- Dr. Swati Joshi, Senior Research Associate, Centre for Technology Innovation and Economic Research
- Ms. Uma Ganesh, Co-founder –5F World, NES and Chairperson –Global Talent Track
- All respondents for their valuable inputs on advancing women in STEM

CII for including women in STEM as a core pillar of focus, and providing this immense opportunity to study the landscape and propose policy-oriented recommendations for increasing the percentage of women in STEM careers.

Best Regards

Ms Sruthi Kannan

Head – Cisco for Startups

Lead – Women in STEM Subgroup, CII National Mission on Technology, Innovation and Research

Executive Summary

Science, Technology, Engineering, Mathematics (STEM) scenario has hugely transformed after independence. Both men and women S&T professionals have contributed to the making of the self-reliant India. However, the socio-cultural set up, gender bias and related stereotypes have restrained gender equality in STEM.

India has 43 per cent women STEM graduates, but only 14 per cent are recruited in the workforce. Although considerable efforts have been made to increase the visibility of women in STEM, we are still lagging in embracing the tenets of inclusion and diversity.

The representation and empowerment of women in STEM is very important as it is one of the key factors that determines the future of Science and Technology.

The entire ecosystem - the Government, academia and industry must make collective efforts to encourage and enable women to pursue STEM in education. There is a huge importance of three “P’s” that includes **Policies**, **Programs** and **People**. There is a need to come up with forward looking policies, implement programs through the participation of right people including women.

With this as a background, CII has launched Women in STEM under CII National Mission on Technology that envisages to enable India take strategic initiatives towards technology leadership

This report is a part of various initiatives taken by the CII to enable and enhance participation of women in Science, Technology, Engineering and Mathematics.

The report has sections covering specific purpose, overview of the status of Women in STEM in India covering trends related to participation, promotion, recruitment, and retention of women in STEM; challenges and barriers; existing evidence, need & objective of the research study. The research study further covers the aim of the study, methodology, data interpretation and analysis, best practices, key recommendations, implications and call to action.

This report has been developed by an intense process to catch the data including online survey through questionnaire, direct interviews of select women etc. The secondary data for the report was taken from the CII Compendium on Women in STEM released in July 2022.

Introduction

Science Technology and Innovation (STI) are the pillars of any nation's sustainable development and equal participation of women in STI is the need of the day. This report brings about a general overview of Indian perspective with respect to women representation and participation in Science, Technology, Engineering and Mathematics (STEM) and therefore leaves the reader with an after-thought on probable areas of focus and re-enforcement.

While in general, there is an increased sensitization towards gender (women) inclusivity in STI, however it's a long road to undertake yet. Existing trends related to participation, promotion, recruitment, and retention of Women in STEM in Indian context has shown percentages to reduce from education segment to workforce segment. The gap further widens when one investigates the data related to women in Senior Leadership roles as well representation in Start-ups/ entrepreneurship. Under-representation of women in STEM education and STEM workforce participation is for obvious reasons associated with its related challenges and barriers. Meanwhile, it is also heartening to note about the various support programs and interventions from various stakeholders (government, academia, institutes, corporates) who have been working towards promotion of women in STEM. Some additional insights have been generated from a research survey in a limited manner encompassing current challenges and enablers for women in STEM.

The report is a reflection of the existing canvas and converges towards possible options of policy changes and interventions in current practices across organizations. Possible recommendations have been made which can be implemented in institutes/ organizations to improve the representation of women in STEM.

2.0 An overview of the status of Women in STEM India

The advent of globalization, scientific breakthroughs, and technological advancements, recognized Science, Technology, and Innovation (STI) as a potent tool to address societal challenges, towards realizing national priorities and sustainable development goals. While efforts are being made to achieve the sustainable development goals and applying STI for development of nations and societies, gender inclusivity in STI is becoming a major concern for policy makers, research scholars and practitioners, across the globe. It has been observed that currently, women account for less than 30 percent of researchers worldwide. Evidently, gender stereotypes and biases have steered females away from science related disciplines (UIS, 2018). Moreover, it has been argued that under-representation of women in STI undermines the advancement of S&T, and its potential for socio-economic development. Some countries and regions struggle to attract more girls to STEM, while others have difficulty to retain or promote women to leadership levels. In the Indian context, despite accounting for about 50 percent of the population, women are under-represented in the STI workforce and so is their participation in higher education in S&T.

There is a significant increase in awareness among policy makers, scientists, academicians and institutions, to promote participation of women in S&T in India. Gender-specific programmes have been undertaken by public institutions and organizations, including Department of Science and Technology, Department of Biotechnology, Indian Academy of Sciences, Women's Science Congress, Niti Aayog and others, to promote and support women's participation and enhance the opportunities for them in STEM and S&T and I. The sensitivity towards gender inclusion can also be observed in some universities (Mallick, 2018; Srinivas, Kumar and Pandey, 2018) as well as in technology intensive sectors (Bhattacharyya and Ghosh, 2012; Subramaniam, 2015). Most of the policy initiatives propose to enhance women participation in S&T education and research as well as promote their contribution to Science and Technology. However, more efforts are required to bring in gender mainstreaming in the Indian STI policy. There is a need to bring in more, gender inclusivity in STEM, in policy and practice. In doing so, it is important to explore and identify the challenges and systemic barriers that have led to the under-representation of women in the fields of science, technology, engineering, and mathematics (STEM). The given section aims to reflect on such issues and highlights current initiatives and interventions existing at institutional, national and global levels which can be taken into account in policies and practices.

2.1 Trends related to participation, promotion, recruitment, and retention of Women in STEM

In this section, we look at trends related to participation, promotion, recruitment, and retention of women in STEM in the country. The effects of the policy push towards education for girls from subsequent governments is visible in the enrollment trends for higher education across disciplines.

The number of women opting to study STEM subjects has been increasing over the past few years as seen in the figures below. The trend in gender parity in STEM is encouraging. The enrollment of females is higher in Sciences, IT and computers as compared to engineering and technology at all levels of higher education.

Trends in Undergraduate STEM Enrollment (2014- 20)

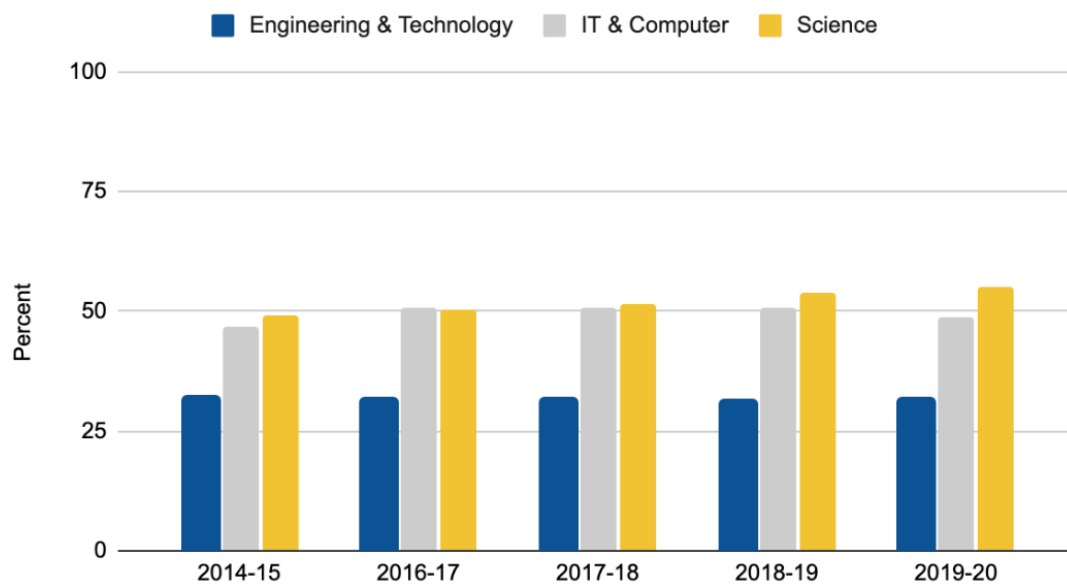


Fig. 1a Women enrollment in STEM - Undergraduate

Trends in Postgraduate STEM Enrollment (2014- 20)

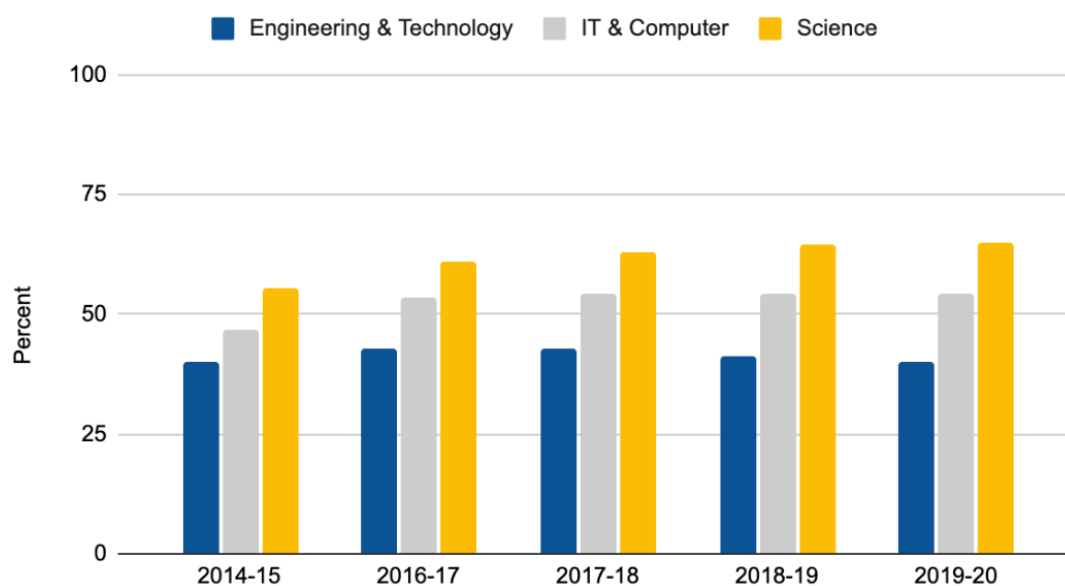


Fig. 1b Women enrollment in STEM - Postgraduate

Trends in PhD STEM Enrollment (2014- 20)

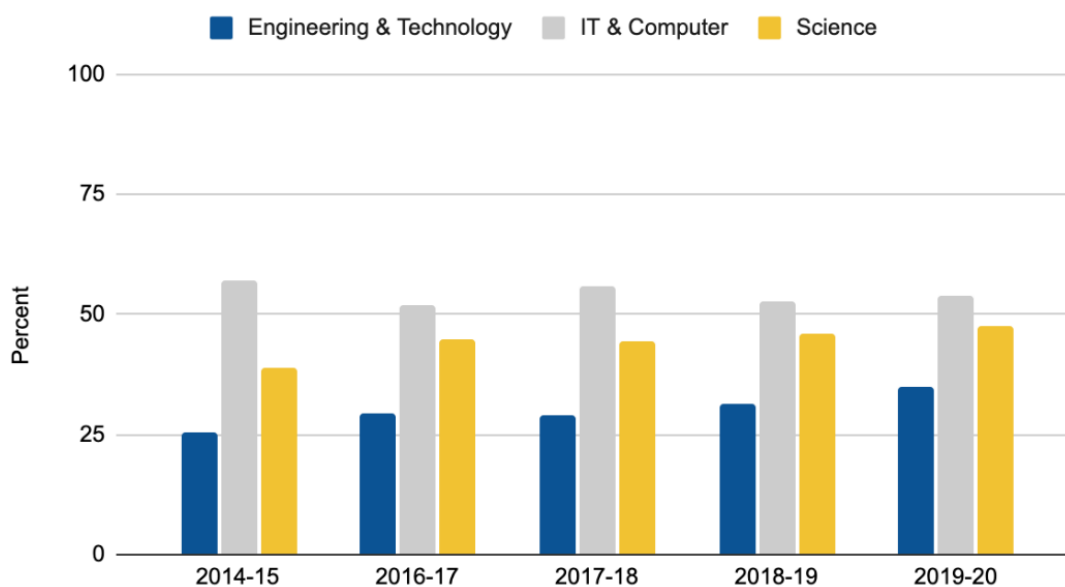


Fig. 1c Women enrollment in STEM - Phd

Source: Ministry of Human Resource Development, Department of Higher Education, All India Survey on Higher Education (AISHE) various report, Centre for Technology Innovation and Economic Research

However, these gains in education related gender parity do not translate to STEM jobs held by women. According to statistics computed by the Department of Science and Technology, the share of women researchers in the public and private sector has not breached 20% over the past decade as seen in Figure 2.

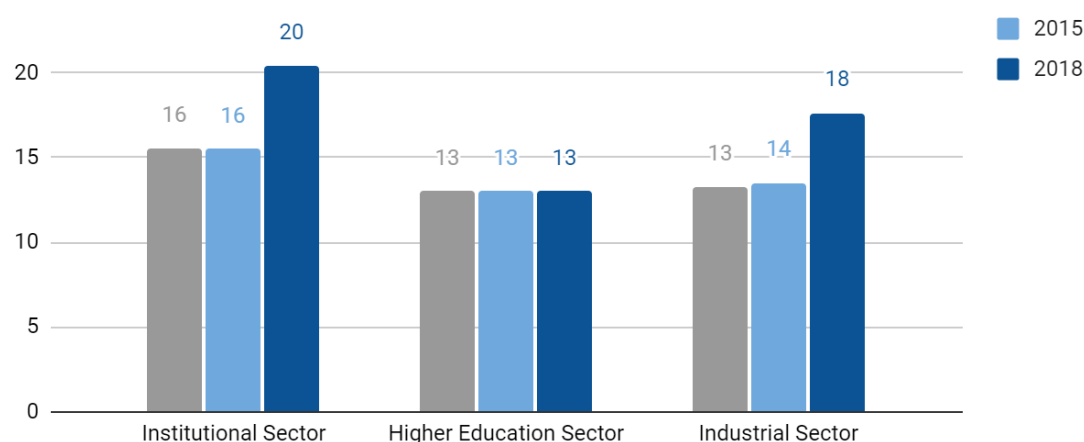


Fig. 2 Share of Women Researchers in Workforce (2010-2018)

Source: R&D Statistics, Department of Science and Technology, Government of India, Centre for Technology, Innovation and Economic Research

Note: Institutional Sector consists of major scientific agencies, Central government ministries/ departments and State governments

Industrial Sector consists of public sector including joint sector, Private sector and Scientific and Industrial Research Organisations

A similar trend is observed for women in professional and technical roles. There has been a steady upward rise in the number of women in professional and technical roles, from 25.3% in 2018 to 32.9% in 2022. However, this rise does not correspond to equal opportunities for advancement. Women get stuck at the same positions early in their careers. The gap widens higher up in the seniority ladder as seen in Figure 3.

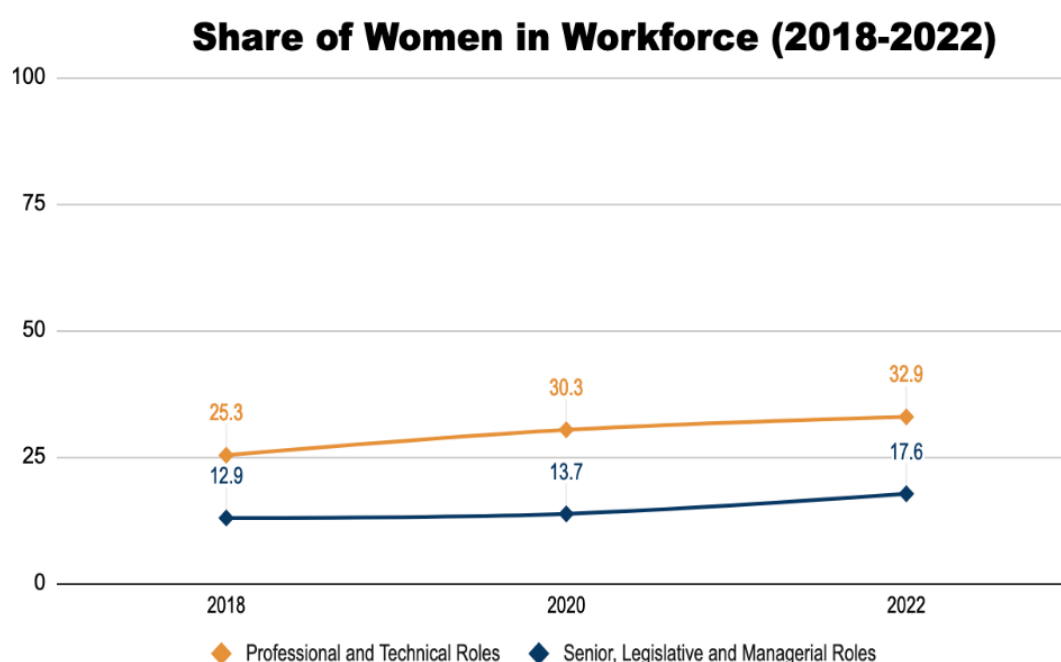


Fig.3 Share of Women in Workforce (2018- 22)

Source: Global Gender Gap Report, World Economic Forum, various years

The failure of organizations to promote and retain women in technical roles, especially at the early stages, not only reflects on the broken promotion system that perpetuates gender disparity but also results in fewer women being prepared for senior roles. We use two different datasets to demonstrate this. First, we look at the trend as reported in the Global Gender Gap report seen in Fig. 3 where we observe modest gains in the share of women in senior, legislative and managerial roles as the share of women increased from 12.9% in 2018 to 17.6% in 2022.

According to LinkedIn data, the barriers for women start early in the career as seen in Fig.4. To begin with, the number of women starting in technical roles is already low at 28% as compared to the global 44%. The under-representation gets more acute up the seniority ladder, with the maximum drop seen at the manager level with only 18% representation of women.

<https://linkedin.github.io/gender-equity-2022/>

<https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/repairing-the-broken-rung-on-the-career-ladder-for-women-in-technical-roles>

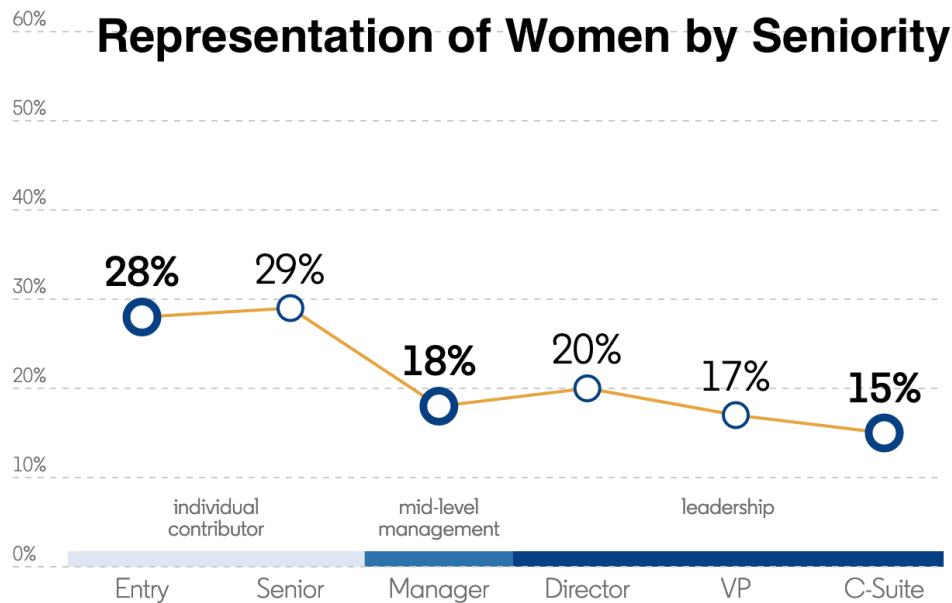


Fig.4 Representation of Women by Seniority

Source: LinkedIn data, 2021

These gender gaps in the workforce are driven and affected by many factors, including long-standing structural barriers, socio-economic and technological transformation, as well as economic shocks. Meanwhile, there is an emerging trend of women creating their own leadership opportunities. There has been an increase in the number of women opting to start their companies as seen in Fig 5.

While this is an encouraging trend, there is a noticeable absence of women leadership as startups become bigger and turn into unicorns. There are a reported 105 unicorns as of 2022. However, only 18 of these have at least one-woman co-founder.

2.2. Existing Efforts

Gender inclusion is not a new idea in India. Initiatives by stakeholders and government policies have been put into practice, time and again, to promote and retain women in science, technology, engineering and mathematics (STEM). The given section explores some of the key interventions of stakeholders in India working to support women and girls in science. Gender inclusion was brought to light in policy discussions in the 1970s, especially with the publication of ‘Towards equality: Report of the Committee on the Status of Women in India’ by the Department of Social Welfare in 1974. Nearly every Five-Year Plan since has included focused policies for women in education and employment; and the sixth Five Year Plan devoted a separate chapter to women and development (Kaur, 2018). Prominent members of the scientific and research industries and members of science academies (detailed later in this chapter) have also made efforts throughout the past several decades to draw attention to the achievements by and challenges before Indian women in science (Godbole and Ramaswamy, 2015). In this section, we focus only on documenting some of the more well-known programs within four main sectors. We have arranged stakeholders across these sectors in Table 1.

Table 1: Main stakeholders supporting women in science

Sector	Category	Examples
Government ministries and inter-agency schemes	<ul style="list-style-type: none"> Ministries Departments Autonomous Institutions 	<ul style="list-style-type: none"> Department of Science and Technology Department of Biotechnology NITI Aayog Ministry of Education (formerly MHRD) National Assessment and Accreditation Council
Academies and associations	<ul style="list-style-type: none"> Academies of elected fellows 	<ul style="list-style-type: none"> Indian Academy of Science Indian National Science Academy National Academy of Science, India

<https://inc42.com/the-indian-unicorn-tracker/>

Academia	<ul style="list-style-type: none"> • Institutes of national importance • Universities funded and run by the Central Government • Universities funded and run by state governments 	<ul style="list-style-type: none"> • Indian Institute of Technology, National Institute of Technology, Indian Institutes of Science Education and Research • Indian Institute of Science, Jawaharlal Nehru University, Banaras Hindu University, Central University of Punjab • Manipal Academy of Higher Education, Goa University, Amrita University, Punjab University
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Government interventions

In India, improving gender equity and inclusion in science, technology, engineering, and mathematics have long been part of on-going efforts to promote and enhance nationwide capabilities in science. DST set up a National Task Force for Women in Science, in 2005, supported by Indian National Science Academy. It aimed to develop a conducive milieu for social, cultural, economic, and geographic inclusion for scientific pursuits. Various schemes were initiated to support women in science. Some of them are highlighted below in table 2.

Programme	Description
Gender Advancement for Transforming Institutions (GATI)	<p>A novel pilot programme, GATI, aims to enhance India's scientific laboratories and institutions of higher education by mainstreaming and institutionalizing gender inclusion across all connected departments. It is adapted from the United Kingdom's Athena SWAN Framework. As an institutional intervention, GATI will create sensitization and awareness, develop an inclusive culture, and address systemic barriers and structural issues hindering women's participation in science education and careers</p> <p>(https://dst.gov.in/scientific-programmes/scientific-engineering-research/women-scientists-programs)</p>
Consolidation of University Research for Innovation and Excellence in Women (CURIE)	<p>Aims to provide opportunities in research, technology development, and self-employment. CURIE facilitates the development of infrastructure in women-only universities to attract, train, and retain promising female students in the fields of science and technology</p> <p>(https://www.indiascienceandtechnology.gov.in/programme-schemes/women-schemes/consolidation-university-research-innovation-and-excellence-women-curie)</p>
Vigyan Jyoti	<p>Provides a more level playing field for meritorious girls in high school to pursue STEM in their higher education. It offers girl students from rural backgrounds with exposure to resources that will aid their journey from school to jobs of their choice in the field of science</p> <p>(https://www.vigyanjyoti.com/)</p>

SERB - POWER (Promoting Opportunities for Women in Exploratory Research)	Launched by the Science and Engineering Research Board (SERB), this scheme provides research funding and support to deserving women scientists to enhance their participation in research and encourages healthy competition (https://serbonline.in/SERB/serbPowerInstructions)
Indo-U.S. Fellowship for Women in STEM	A joint initiative of the DST and the Indo-U.S. Science & Technology Forum, this scheme provides opportunities to Indian women scientists, engineers, and technologists to undertake international collaborative research at premier institutions in the United States (https://www.indiascienceandtechnology.gov.in/programme-schemes/women-schemes/indo-us-fellowship-women-stemm)
Biotechnology Career Advancement and Re-orientation Programme (BioCARE)	The program offers career development specifically for women early in their careers, targeting both employed and unemployed women scientists under 45 years of age. It is designed for women attempting to return to careers after a break. The Ministry of Earth Sciences, Ministry of Defence and others are making similar efforts (https://www.indiascienceandtechnology.gov.in/programme-schemes/women-schemes/biotechnology-career-advancement-re-orientation-programme-biocare)
Udaan	Aims to enrich the teaching and learning of science and mathematics in schools by addressing the three dimensions of education – curriculum design, transaction and assessments. The goal is to redress the low enrolment ratio of women students in prestigious engineering institutions. (https://www.india.gov.in/spotlight/udaan-program-give-wings-girl-students)

Source: UNESCO (2022)

Women Scientist Scheme	Provides incentives for women to pursue healthcare research after a career break. It focuses on career development, funding and skill-building (https://dhr.gov.in/sites/default/files/Women%20Scientist%20Scheme.pdf).
Lilavati Awards	Aims to promote scientific education and career development for women.
Women Entrepreneurship Programmes	Encourage females to pursue technology-led startup and foster entrepreneurship development.

Academic and research institutions

For this section, we have taken examples of a few academic and research institutions, including institutes of national importance and central and state universities, that have made efforts to support women in science. Our list is not exhaustive but represents leading higher education institutes that set the standard, in many ways, for other Indian universities.

We see instances of immense work in India to increase the participation of women in science. For instance, the Indian Institutes of Technology have introduced supernumerary seats (seats in excess of the usual or requisite number) that are reserved for women and intended to increase women's enrolment to 20 per cent. Another way that institutes of national importance support women in science is by establishing gender initiative and support cells. IIT Bombay has had a dedicated Gender Cell since 2002, working to advance equality and awareness, and prevent violence, to make the campus safer for and more supportive of women. Similarly, many of the National Institutes of Technology (NITs) have women's cells to protect women against harassment. The NITs can boast of more women enrolled than the IITs (Verma, 2018), with NIT Andhra having the highest percentage of women students than the other NITs at 30 per cent. NIT Jaipur has reserved 30 per cent of its scholarships for women while NIT Hamirpur has a Prime Minister's Merit Scholarship for female students. Similarly, various Central universities have made determined efforts to support their female faculty, from gender non-specific tenure policies to focused discussions on increasing women's representation in the sciences. One of the

best examples of such efforts is the Bengaluru-based Indian Institute of Science's 'Tenure Clock Pause' policy (IISc, 2017). This system allows anyone (regardless of gender) to stop their tenure clock for one year per child, with a maximum extension of two years. Such measures are meant to relieve some of the pressure on parents who have children and still want to maintain a career path towards seniority and promotions despite increased responsibilities at home.

State universities have implemented many institutionally spearheaded efforts to support women in science. Goa University has a policy on 'gender equity and sensitivity' whose guidelines explicitly call to improve women's participation and representation in STEM and any other disciplines in which women are under-represented. Similarly, Kurukshetra University established a Women in STEM forum in 2019 to create awareness about careers, opportunities and funding schemes in STEM for women students, researchers and faculty. The forum aims to retain women in science by facilitating interactions with senior and accomplished women faculty members in STEM within and outside the university.

Table 3: Other notable interventions by academic institutes

Institute	Programme	Description
IIT Delhi	Initiative for Gender Equity and Sensitization	One of this programme's mandates encourages gender dialogue in STEM. Additionally, IIT Delhi offers student and career counselling for women to support their move from study to industry (IIT Delhi, 2020). The institution has also announced an office of diversity and inclusion. ^[6]
IIT Kharagpur	Student grants exclusively for undergraduate women	A significant portion of this IIT's student grant programme (₹65 lakh) is earmarked for undergraduate women. The institute also provides counselling and outreach initiatives for women looking for a career in science (IIT Kharagpur, 2021).
IIT Bombay	A dedicated chair for women faculty	A significant step toward recognizing women leaders in academia who can serve as role models for aspiring students.

IIT Madras	Women Leading IITM	An alumni-sponsored initiative that aims to guide and support women graduates through professional networking, scholarships and mentorships.
IISER Pune	Prodigious Women in Chemical Sciences	Managed by the IISER committee on Women and Science, this programme organises conferences and strategic planning meetings to improve gender equality. IISER also runs an on-campus childcare centre for working parents in the institute.
Tata Institute of Fundamental Research	Child Care Association	The institute's Women's Cell managed this initiative so successfully that not only does it provide quality child care, but in such a way that both parents benefit from its services.
Indian Institute of Science	Women in Science	IISc celebrates the women teaching and working in the institute through a dedicated website and promotes funding opportunities for women scientists as part of its Office of Research Grants and through its affiliation with the Indian Academy of Science's Women in Science initiative. (https://iisc.ac.in/women-in-science/)

Source: UNESCO (2022)

Industry

In principle, scientists are trained to pursue careers in research and industry after obtaining an academic degree. There is an extreme and unexplained gap between the number of women who graduate with advanced degrees in science and those who are employed in a relevant industry. To reduce this gap, the science industry in India can best help women in science by providing unbiased work opportunities, safer and more supportive work environments and infrastructure, and boosting women's participation in science both as part of their Corporate Social Responsibility (CSR) activities and normal operations.. Women scientists seeking jobs outside academic research face particular hurdles when trying to

join the science industry, especially because of their limited access to science and engineering (National Academy of Sciences, 2020). Despite progress in this area, common recruitment and hiring practices make extensive use of traditional networks and have historically overlooked the available pool of women. Hiring practices in most industries now use artificial intelligence and machine learning (AI) within their systems. Researchers have raised concerns that many AI hiring software can have in-built biases that favour men and disparage women and minorities (Cheong et al., 2020; Dattner et al., 2019; Gebru, 2019). We need to establish an Indian alliance between academia and industry, with clear considerations of gender equality and gender-based opportunities to improve work avenues and work environment for women.

Many companies have taken initiatives to boost women's participation in STEM, recognizing both the inherent value of such efforts and how a stronger, more diverse workforce contributes to the company. Companies like L'Oréal (in partnership with UNESCO), Larsen & Toubro, IBM, Cisco, Microsoft, Adobe, Intel, and Google, among others, have actively promoted women's participation in science as part of their CSR activities. Creating more inclusive environments with infrastructure improvements, crèches to support working parents, mentorships and community outreach to inspire young women studying science are all examples of what some of these leading companies are doing to support women in science.

The IT industry offers several examples of initiatives for women employees. For example, Microsoft established its Codess community for female coders to explore ways of promoting gender diversity in the engineering field. Codess aims to create a forum that inspires female coders and helps them achieve professional goals through networking events, mentoring and sharing advice and experiences.

The industry has advanced more initiatives like these, not only to address the challenge of inviting women into science but also to help retain them in the field. The science industry and its ecosystem directly impact women scientists' career trajectories. The industry plays an important role as an actor and stakeholder for women in science, both in their progression from higher education to employment in the sciences and in their retention..

Some other notable industry programmes for women in science are detailed in Table 4.

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Table 4: Notable industry programmes for women in science

Organisation	Programme	Description
Tata Motors	Diversity Council	Diversity Council, at apex and unit levels, is tasked with increasing gender diversity in the organisation and the initiatives are regularly reviewed by Senior Leadership team
	Second Career Inspiring Possibilities (SCIP)	<p>Second shifts opened for women increased women hiring and there has also been substantial increase in campus hires</p> <p>Second Career Inspiring Possibilities (SCIP) enables women with good work experience to find their way back after a career break</p> <p>Crèche facility for women working in the commercial and corporate divisions (https://www.tatamotors.com/wp-content/uploads/2022/06/annual-report-2021-22.pdf)</p>
TATA Steel	Women @ Mines	<p>Widened opportunities for employment of women across all sections of TATA STEEL mines under the flagship program of 'Women@Mines'</p> <p>Exclusive platforms created: MOSAIC - Diversity & Inclusion (D&I) initiatives, Women of Mettle, Women@Mines, Tejaswini and other programmes</p> <p>(https://www.tatasteel.com/media/15928/tata-steel-ir-2021-22.pdf)</p>
IBM	Department of research, diversity and inclusion	<p>This department strives to create a conducive and inclusive work environment for women researchers and introduces initiatives that help women address the professional challenges they face.</p> <p>(https://www.ibm.com/employment/inclusion/downloads/empowering_women_in_tech_ibm_case_study.pdf)</p>
Cisco	WISE Women of Impact	"Women of Impact" aims to create, foster, and develop a pipeline of women leaders within Cisco and JUMP is a program that brings high-potential women employees together to focus on strategic leadership thinking.

		<p>Women in Science and Engineering (WISE) Employee Resource Organization at Cisco is a thriving, inclusive community of technical women and allies focused on positively impacting the lives of women and girls in STEM fields inside and outside of Cisco.</p> <p>Cisco Netacad partnered with the Women in Cybersecurity network (CWICS) on 'Boost,' a program that aims to empower and support women in cybersecurity and help to boost their careers. (https://www.cisco.com/c/en/us/products/security/women-in-cybersecurity.html)</p>
Adobe	CodeHers	A women's-only hackathon to celebrate women in STEM. It aims to help identify the brightest women developers and coders in India through a series of algorithmic programming challenges. (https://www.hackerrank.com/adobe-codhers/).
Intel	Protégé Sponsorship Initiative	This initiative creates development opportunities for select senior technical women employees by mapping each of them to a senior leader as sponsor. Intel also plans to ultimately reach full gender representation (Intel, 2016).
Larson & Toubro	Renew: Career re-entry for women	A one-of-its-kind initiative that only hires women professionals who took career breaks for any significant reason. This initiative is a step forward in bringing women who left the sciences back into the field. (https://www.larsentoubro.com/corporate/careers/renew-career-re-entry-for-women/).
HCL	SheInspires	This initiative captures the life stories of women who have excelled in different STEM fields. It aims to inspire young women and girls to pursue science (https://www.hcltech.com/sheinspires#sheInspires).
Tata Consultancy Services (TCS)	Million Women Mentors (MWM) Joint initiative	A unique initiative launched in 2020 to provide valuable mentoring to women in science and development of a digital platform for showcasing best practices, resources and discussing challenges of gender equity and inclusion. (https://www.tcs.com/corporate-social-responsibility/partnership-pages/million-women-mentors)

Dr. Reddy's Laboratories	Dr. Reddy's Foundation Sashakt Scholarship	A scholarship programme for girls from rural areas and economically weaker sections of society, to pursue higher education in the field of science. (https://drreddysfoundation.org/sashakt/)
Wipro	"Women of Wipro" (WOW) programme	"Women of Wipro" (WOW) programme, promotes gender equality and equal opportunity within Wipro, for supporting the career ambitions of women in technology and facilitating leadership positions. (https://www.wipro.com/newsroom/press-releases/archives/wipro-limited-recognized-as-champion-of-womens-empowerment-princ/).

Source: UNESCO (2022) and Annual Reports

With respect to Industry consortia, The Confederation of Indian Industries (CII) not only acts as industry chambers but also as pressure groups to lobby demands and improve industry environments. It does not deal with scientific research and development industries specifically; however, it has recommended best practices that are more universal in nature that could be implemented within science industries.

For over 125 years, CII has been committed to improving the development and health of India's economy by supporting positive transformations in the practices and management of industries. To address gender equality specifically, the CII formed the CII-Indian Women Network (IWN) in 2013, aiming for it to be India's largest network of career women. The IWN is managed and held entirely by women.

The IWN's goal is, in part, to provide a structured network through which career women can meet to discuss and overcome challenges they might be facing at the workplace. The IWN works towards enabling women to become better professionals and achievers in their fields. The IWN's website boasts of plenty of activities and events that fit in almost all sectors of industry, including technical and professional skill training, career counselling and a range of gender sensitivity programs. The organization's methodology focuses on awareness programmes, policy advocacy, consultancy services, training, recognition and mentoring. Scientific R&D industries would benefit from adopting some of IWN's best practices, especially with policymakers and other stakeholders. Their public communication standards are also commendable in how they ensure that the public is aware of existing standards and the good work being done.

Other interventions

- The Indian Association of Women Scientists (IWSA) is a Mumbai-based organization that has worked on different aspects of promoting women in science since its inception in 1973. As a representative body of women in science and technology, it aims to promote scientific accomplishments among women scientists, understand the problems of women in science and provide solutions for women's empowerment (<https://iwsa.net/about-us/iwsa-in-brief/>).
- Life of Science, started in 2016, is a science media platform that not only collates the experiences of women and minorities in science, collected on lab-hopping journeys across India, but also focuses on contemporary research intersecting gender and various societal barriers. The platform brings female voices into Indian science in the media and includes science communicators, scientists, graduate students, journalists, artists, and multimedia content creators (<https://thelifeofscience.com/>).
- The European Molecular Biology Organization (EMBO) has long questioned the basis of gender imbalances in the life sciences. In 2016, following an agreement signed by the Government of India, EMBO and the European Molecular Biology Conference (EMBC) to strengthen scientific interaction, collaborative research between India and Europe, India became an Associate Member State of the EMBC. EMBO monitors its programmes frequently to ensure gender balance and fair treatment, including of researchers with family obligations. It co-funds courses, workshops and conferences and supports individual scientists (<https://www.embo.org/policy/women-in-science/>).

2.3 Challenges & Barriers

Evidently, India has achieved commendable progress in some areas of gender equality in the STEM domain, but still faces critical challenges for science to flourish in a gender-equitable way. In this section, attempts have been made to draw attention to the multi-dimensional obstacles that women face in pursuing a career in science, including infrastructure and access to resources, but also (perhaps more importantly) socio-cultural biases that begin at home and permeate the workplace and education systems.

There is a wealth of existing reports on the status of women in science, including valuable datasets and analyses. The most important of these publications include: The Indian National Science Academy's report on 'Science Career for Indian Women' (2004); The Department of Science and Technology (DST)'s

‘National Task Force for Women in Science’ report (2009); R. Godbole and R. Ramaswamy’s (2015) ‘Women Scientists in India’ AASSA book chapter; and the Inter-Academy Panel on Women in Science’s A Road Map for Women in Science and Technology – A Vision Document (2016).

It is essential to examine these key reports to contextualise the problem and, in so doing, identify areas of progress and gaps that need to be addressed. Mounting evidence suggests that too many interventions designed to promote women in science are not guided by sufficiently broad and multi-faceted understanding of the problems women face (Beeler et al., 2019; Blickenstaff, 2005). While it is important to recognize that India has achieved significant progress on some key indicators for supporting women in science, especially in education, some systemic barriers and challenges within India’s education system continue to challenge women’s access to education.

According to many studies, the most significant barrier for women in science is maintaining a career within institutions that are designed by and for men (Easterly and Ricard, 2011). There exist inherent biases in many existing educational, professional, and industrial institutions, namely that they have been designed based on larger societal norms that primarily reflect the socialisation and learning styles of men (Alfred, 2001). The progression from education to career does not happen in a vacuum. An individual’s journey is influenced by a multitude of sociocultural factors (Malone and Barabino, 2009; Swarup and Dey, 2020). While a significantly higher number of women have acquired scientific degrees when compared with men, and this trend is consistently increasing over time, women remain a minority among persons employed in science in India.

As we have seen in earlier sections, the rapid progress and increase in women’s Gross Enrolment Ratio (GER) in higher education in India is commendable, reflecting a national culture that is pro-education. However, some experts refer to as the ‘paradox of a gender inclusive university’ whereby women have gained access to higher education but have been largely relegated to non-professional, non-market, non-prestigious subjects, constrained in their choice of subject to ‘feminine appropriate’ disciplines and subsequent careers (Chanana, 2007). This is largely because subject and career choices in India are often family-driven, where the values of the parents dominate (e.g., their daughter’s safety or how certain careers might affect her marriageability). In some of the more prestigious subjects within the sciences, including chemistry (42 per cent), physics (38 per cent), and engineering (32 per cent) women’s enrolment remains relatively low. However, other fields, like the life sciences (56 per cent), microbiology (67 per cent), and Information Technology/computer sciences (54 per cent), boast high enrolment of women (Ministry of Education, 2020a). In India, this has been described as ‘horizontal gender segregation’ whereby gender divisions are reinforced within sub-fields and specialisations (Tambe, 2019).

The social, cultural, and infrastructural barriers confronting women in science are well-documented, and may seem obvious, but must be included in this report. This is because they have a profound bearing on women's transition from education to then building a career in science research, participating in the science industries, and finally assuming leadership in the field. It should be noted that the relatively small increase in female faculty over time does not reflect the increase in women obtaining doctorates (Ministry of Education, 2020a).

Social and cultural barriers

Social and cultural barriers that hinder equitable access include class and caste barriers that inhibit access to education (and subsequent employment), infrastructural and cultural barriers that inhibit access to education, and social and cultural barriers that inhibit women from participating in the workforce (Kurup et al., 2010; InterAcademy Panel on WiS, 2016). In India, especially, the extreme diversity of cultural and ethnic groups requires a deep understanding of regional and other context-specific factors to pinpoint how to best address challenges (DST, 2009). Marriage, children, household pressures and other family responsibilities have also been noted as reasons for women to either not join the workforce in the first place, or to leave it (Mitali, 2021). These hierarchical and patriarchal norms spill into the workplace and affect women scientists' day-to-day interactions and activities negatively (Gupta, 2016).

Many women take career breaks after they marry, after the birth of their first or second child, to attend to other duties of family care under family pressure, when burdened by increased household labour, or for other personal and family reasons. Women who have pursued a scientific education and continued into a scientific career face additional and specific cultural barriers and social challenges within science industries (Kurup and Maithreyi, 2011).

Horizontal segregation and the glass ceiling

Horizontal segregation seems to become more pronounced higher up the career ladder, with fewer women represented in prestigious academic and scientific fellowships, memberships of scientific communities, and leadership in research labs. Some social historians have connected this culture of exclusion to the social power dynamics of the early twentieth century when wealthy, privileged-caste men dominated scientific communities (Sur, 2012).

The minority status of women in the sciences can also have a paradoxical 'heightened visibility' effect whereby the performance and qualities of this

minority are magnified and generalised to all women (Kanter, 2008). Many women struggle to balance professional and familial responsibilities, and therefore are more likely than men to take time off from their careers. Because of their heightened visibility, women scientists' time off is not understood as a common and expected result of the norms of India's socio-cultural context. Instead, women who take time off are compared to men who do not take time off and found lacking. Therefore, women, in general, are stereotyped as inferior employees and scientists. This contrasts with men in science, who are constrained by different yet interrelated social norms, but do not have the additional societal expectation of the unpaid, unacknowledged Second Shift (Hochschild and Machung, 1989). These deep-seated, and often generational, social norms are slow to change, despite rapid social progress and can reinforce the glass ceiling for many women.

The glass ceiling is further reinforced by social biases and pressures from family, peer groups and even from the women themselves. Global trends point to a general decrease in overt sexism or crude gender biases (Etaugh & Bridges, 2017). Encouragingly, in India, issues of salary gaps and overt gender discrimination in the workplace are improving (Goel, 2018). However, subtle and 'invisible' sexist behaviour is strongly present, so that women are relegated to less strategic roles with limited opportunities for leadership or recognition (Chanana, 2007). This has also been called 'second-generation gender bias' (Ibrarra et al., 2013). Such subtle biases are most prevalent in the day-to-day workplace experience and create a culture that is less supportive or appreciative of women's contributions. In one workplace ethnography (Goel, 2018), researchers found that men generally perceived women as 'outsiders' intruding on their space, as being less intellectually capable, and as poor performers overall. The study also found that women were less likely to speak up or complain about such treatment for fear of losing their jobs – serving only to reinforce the invisible bias. Several similar research studies point out that this trend is especially prevalent in countries with strong patriarchal norms, including India (Ernst and Young, 2015; Hassan, 2014; Radhakrishnan, 2012).

Other examples of the invisible biases that women experience include:

- Hierarchy with deep patriarchal trends (Gupta and Sharma, 2003).
- Social perception of Indian women's idealised roles in Indian culture (Gupta, 2016).
- Performance assessment criteria that reward behaviours culturally more acceptable to male scientists (Etzkowitz, 2007), such as staying late at the office or lab.

- The push for women to engage only in culturally ‘acceptable sciences’, such as the biological sciences (Swarup and Dey, 2020), rather than entering fields such as physics, chemistry and some engineering disciplines.

Another potential challenge for women can come from the social values many are raised with, especially in terms of ensuring marriageability. Earning a degree in science is a matter of pride in and of itself and can increase the marriage prospects of the degree holder (Mukhopadhyay, 1994). This can translate into a lack of enthusiasm for the sciences as a career, in that some may view their work in the sciences as just that – work, just like any other job, and often just a means to an end (Arora, 2021). A degree in the sciences can open doors to lucrative job opportunities and invite social prestige, and it would be no surprise to find many students engaged in science for that reason alone. This approach to a career in the sciences is legitimate, given that individuals have preferences that should be respected, but it invites the question ‘How can women be inspired to pursue science as a career?’ Such passion and enthusiasm are necessary to create inspired and committed scientists who can make the changes outlined in this document. While we are mindful of not placing the burden of change upon women alone, it is also important to recognize the role that enthusiasm plays in the process. Studies have demonstrated that the level of enthusiasm impacts subject selection by students, especially school-age girls (González-Pérez, Mateos de Cabo, and Sáinz, 2020).

Emphasis on invisible biases should not be interpreted as a dismissal of more visible forms of discrimination or violence against women. Women’s safety in public places, including the workplace, is of utmost importance when discussing inclusive and supportive working environments for women. The specially appointed Justice Verma Committee dissected existing Indian laws on women’s safety, including human trafficking, sexual harassment, verbal sexual assaults, acid attacks, honour killings and child sexual abuse, as well as marital and non-marital rape (Verma et al., 2013). The committee’s report found that these laws had good intentions but lacked enforcement. The report also discussed the need to address stereotypes through education and perception reforms, reforms in terms of medical and legal examinations, and police and electoral reforms. Additionally, it offered several suggestions for improving public safety for women including well-lit roads, CCTV cameras in public transport, security in public transport after 5:30 p.m., and increased sanitation facilities for women. The Indian Government has taken these recommendations seriously, and they should also factor into any policies on gender equality. This includes women in science programs, where women’s safety should be reinforced as a primary concern.

Privilege and poverty

The hurdles that women face in scientific research and industry indicate that those who achieve success in their fields are often privileged in one way or another. To ignore the influence that privilege and high social status has in academia and other research organisations would be wrong. A significant proportion of India's population still lives close to or below the poverty line, with all the social and economic challenges that this entails. To make a career in science viable and attractive for people living in such conditions requires creative and strategic approaches.

Men living in poverty may also face challenges in establishing a career in science; however, there is ample evidence to show that women undergo far more employment hardships because of poverty (Pande, 2007). To this end, we need more qualitative or similar research to determine exactly what privileges or resources propel certain women beyond the challenges that impede so many others who have equal or greater intellectual capacity (Arora, 2021). Success stories and recommendations from women in below-poverty-level (BPL) circumstances would go far in inspiring all segments of the population and avoid alienating those who were not born into wealth and privilege.

Lack of Data

Much of the historical research on women in science has focused on the education sector – fittingly enough, as it is most often the first stage of an individual's path to their career. Subsequent stages of professional development (employment, career gaps, proportion of public funding, for example) have only been taken into consideration more recently; therefore, there is limited information on these areas. Similarly, technology and engineering, being the most popular fields in higher education and representing the fastest growing industries, are the arena for most of the gender equality related research (Parikh and Sukhatme, 2004) leaving other fields of science under-represented. Women's representation in local, start-up industries within the sciences is also largely unstudied. Given the Indian Government's recent support for start-ups and India-based industries (e.g. the Ministry of Commerce and Industry's 'Startup India' scheme), understanding how women are represented in this burgeoning sector of the economy would help ensure that future programmes include a gender component in their design and implementation.

Without sex-disaggregated data on how scientists transition from school to careers, and how these careers progress, it is difficult to pin-point areas where women struggle particularly. We also need more research on the barriers that women from minority populations face in terms of access to education, reasons why they might not choose science as a field to study, and other influencing factors that could, potentially, be addressed in the future. This kind of data may exist in alternative formats but may not have a sex-disaggregated lens. Work towards transforming existing data into sex-disaggregated data will be very useful.

There are some exceptions to this general trend, including annual reports by the National Institute of Educational Planning and Administration (NIEPA) and its dedicated Centre for Policy Research in Higher Education (CPRHE). These annual publications often include sex-disaggregated data, to some extent, but are not free to access and so may be unobtainable for stakeholders, including the public. Another exception is a recent study that analysed the proportion of Indian female and male principal authors published in peer-reviewed journals and found that male authors out-publish females by 3:1 (Thelwall et al., 2019). The study also found that women published far more in ‘people-oriented’ fields where the primary focus was human subjects; whereas the focus of male principal authors was more ‘thing-oriented’ – that is the material sciences. This and other notable findings supplement existing research in gender stereotypes in the sciences, including a generalised preference for certain fields among female and male students. These preferences also produce more challenges for individuals who attempt to enter a field not aligned to gender norms.

The lack of important data seriously impairs discussions on how to address the lack of women in science, for this report, we have used available data to identify a set of important gaps where women in science are missing, and areas where significant progress has been made. For those sectors and fields for which data are missing, we have made inferences, where possible, to ensure that these important areas are not ignored and to encourage more studies to fill the gaps.

While the nature of many challenges is fundamentally social (and multidimensional), and require time and slow change, it is important to develop a framework of understanding to move forward. In this context, a research study was designed and conducted to understand the challenges faced by women in STEM and how to provide them with the right career enablers to increase women’s representation in STEM. The next chapter details out the research study and the outcomes.

3.0 The Research Study

3.1 Aim of the Study

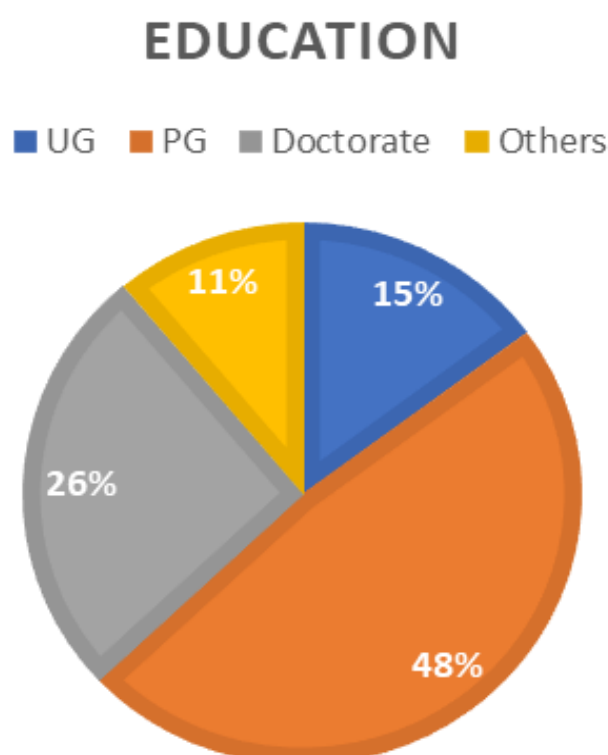
The primary research undertaken aims to substantiate the existing research and data regarding the challenges faced by women in STEM and how to provide them with the right career enablers to increase women's workforce in the STEM sector in the country. The study also aims to identify and showcase best practices and policies that companies have for gender inclusion and furthering women's employment in STEM. Consequently, it aims to create a purposeful framework for organizational stakeholders towards helping women to increase their representation and have successful careers in STEM.

3.2 Methodology

The data was collected through a survey questionnaire shared online with women working in STEM. There were 27 responses received in total for the survey, which had a combination of qualitative and quantitative questions. In-depth interviews were conducted to gain insights from senior women leaders working in STEM.

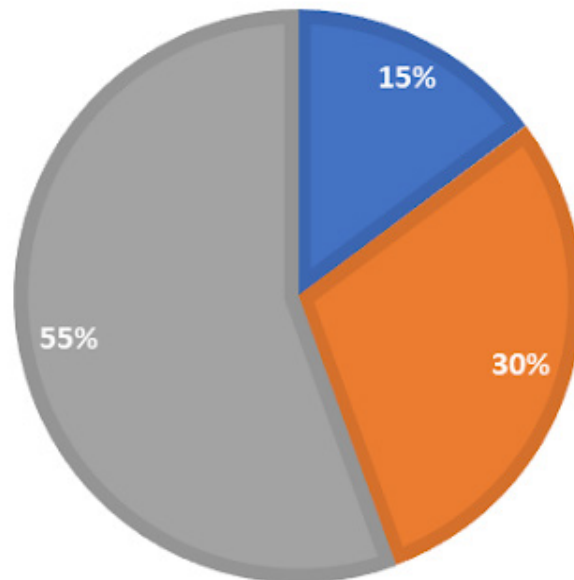
3.3 Respondent Demographics

The key characteristics of the respondent demographic is presented through the charts below:



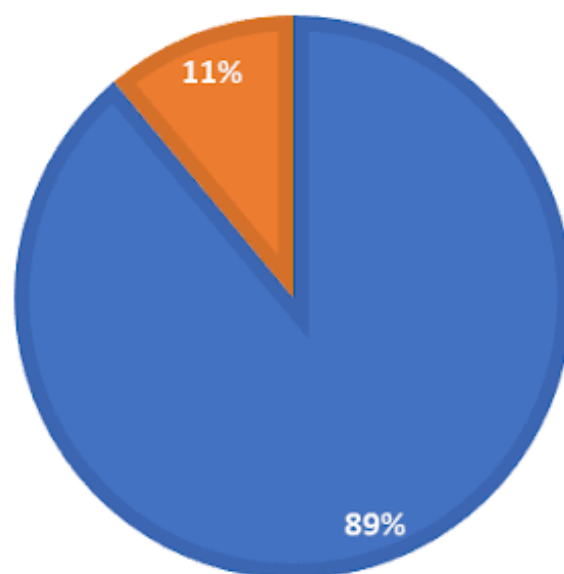
WORK EXPERIENCE

■ Less than 10 years ■ 10 to 20 years ■ More than 20 years



ORGANISATION TYPE

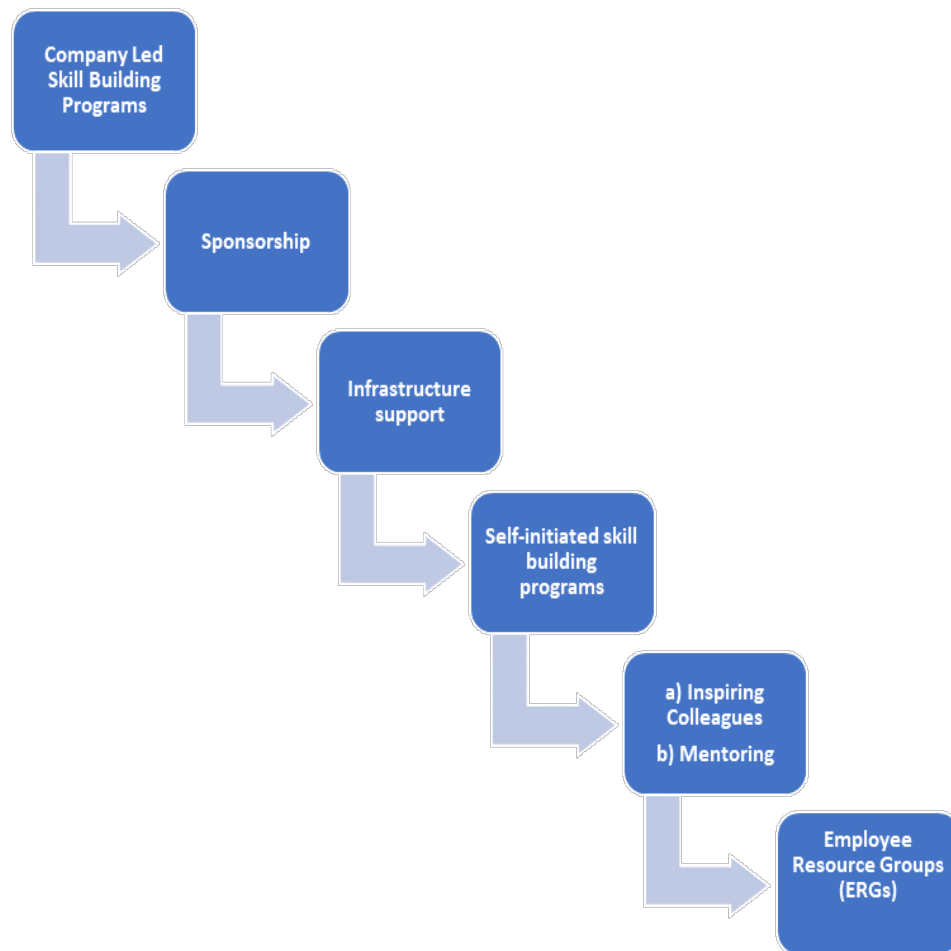
■ Corporate ■ Academia



3.4 Data Interpretation and Analysis

The survey aimed at finding out the key enablers required by women which would help them sustain and progress in their careers in STEM. Career Enablers, as per research by Avtar, are frameworks of support that help professionals in successful career pursuit. They can be either self-initiated or organization provided.

The career enablers ranked most to least important by the overall respondents is depicted below:



The following definitions of the career enablers were provided to the respondents in the survey

1. **Company Led Skill Building Programs:** This refers to programs by an organization to help employees acquire specific skills, both technical and soft skills to improve productivity
2. **Sponsorship:** This refers to senior leader (sponsor) is made responsible for the development and success of a junior professional (sponsee).

3. Infrastructure support: This refers to creche/ childcare center provided by the company within its office area or childcare of employees via tie-ups with child-care centers or flexible working arrangements including work from home, flexitime etc.

4. Self-initiated skill building programs: These are skill building programs (like courses and certifications) that a woman professional enrolls herself for.

5. Inspiring Colleagues & Mentoring: This refers to an individual or group which is comprised of a woman professional's colleagues/friends and of which she is an active member.

6. ERGs (Employee Resource Groups): Structured networks of employees that meet (physically or virtually) to discuss challenges faced commonly by members of the network and initiate programs/ solutions for these challenges

One of the key inferences from the ranking is that strategic career enablers like company led skill building programs and sponsorship are of greater importance than enablers like flexible work and creche facilities.

However, to understand the specific needs of women according to their life and career stage, the ranking of career enablers were further analyzed based on the years of experience at work.

The ranking of the career enablers from most important to least important across career stages is listed below.



3.5 Key Highlights

The analyses reveals that there should be customized initiatives to enable women in STEM to retain them and help them grow in their careers.

The in-depth interviews with women leaders also investigated the challenges faced by women in STEM and the way ahead. The following are the key highlights from the interviews.

“Marriage, maternity and motherhood – the 3Ms are the possible causes of decline of women in STEM from 70% to 4% as women are completely cut off from the world. And there could be several steps which could ensure that this decline is minimized. Organizations could ensure that while the woman employee is on maternity, all mails to be copied to her so as to keep her in loop, and a 2-month part time option during maternity transition, could help more women join back work. Extending childcare support beyond 3 to 4 years could also ensure more women in STEM in India. Apart from that having a “zero year” in the organization to catch upon research and development could be a right step in the area of upskilling. Women by nature are multitaskers and recyclers, hence will have a crucial role in achieving SDGs.”

- Anuradda Ganesh, Director, Cummins Technologies

“I took a break for maternity, childbirth and when my kids were in 10th and 12th during their board exams. And during my breaks I understood that, over any period, technological changes are huge. Hence, I pivoted my career to marketing, to upskill on business administration. Interestingly, both my daughters chose STEM, the elder one is an engineer and younger has a master's in Human-Computer Interaction. Later in a career in STEM, the focus shifts from core competencies to managerial and fiduciary roles. And therefore, managerial and financial training is essential for this transition.”

- Jessy Allan, Marketing Leader. Cisco Systems.

“There should be specific and customized initiatives for women in technology and women in research as the work demands are different for both areas. For women in tech, maternity and motherhood often leads to a break, from which they struggle to come back. Having more opportunities and programs specially for women returning from break can help here. For women in research, create more opportunities to travel abroad and interact with international peers and mentors. This can not only help in broadening the horizon but also to contribute better ideas and bring about a change in the work culture by imbibing the best practices.”

- Uma Ganesh, Co-founder –5F World, NES and Chairperson –Global Talent Track

The study has also come up with a framework of best practices specific for recruitment, advancement, and retention of women in different career stages pertaining to STEM sector, which is as follows:

Career Stage of Women	Recruitment Practices	Advancement Practices	Retention Practices
Early-Career	<p>1. Diversity Slate - to ensure there is no conscious or unconscious bias which creeps in the hiring process, organization mandates to have minimum ONE woman candidate as a part of the diversity slate; failing which the hiring managers cannot close the position</p> <p>2. Diverse interview panel – appoint at least one woman in the interview panel, who is not from HR or Talent Acquisition team.</p> <p>3. Gender-neutral job postings using Machine Language</p>	<p>1. Robust Women's Development, Leadership and Progression Programs. Women at all levels to receive access to a network of leaders, alongside the opportunity to acquire new skills through on-the-job learning, rotational assignments, coaching & mentoring, skill building sessions, career intentionality workshops.</p>	<p>1. Maternity and Parental Benefits & Policies Enabling women at this significant life stage to balance work and life with industry - Key highlights include – Primary Caregivers = Maternity = Adoption = Surrogacy = 26 weeks + Additional optional leave for full-time and part time employees = 4 weeks of paid maternity leave due to pregnancy-related illness, as well as 12 weeks of unpaid leave.</p> <p>2. Returning Mothers Program - Coaching and staffing support from experienced women executives to successfully transition new mothers from maternity, back to successful careers.</p> <p>3. Remove gender barriers: include building sensitivity through unconscious bias training for managers to avoid gender stereotyping.</p>
Mid-Career	<p>1. Alumni Network - to ensure organisations are able to not only hire gender talent from the marketplace but also attract boomerang talent – who are acquainted with the organization culture</p>	<p>1. Robust mentoring and sponsorship programme to build a healthy pipeline of women leadership talent.</p> <p>2. Groups made for and by women employees to get together to share ideas and experiences and seek advice on personal as well</p>	<p>1. A well-being dashboard to keep employees informed on a regular basis about 'disconnected' time off, flexibility and predictability options, campaigns around 'unplugging', and sessions on gratitude and</p>

	2. Every year have a focused hiring drive attempted at attracting women talent	as profession development.	happiness, and holistic well-being programs. 2. Regularly raise awareness of biases among people managers during key activities for their workforce throughout the year, for example prior to their yearly talent planning and performance discussions.
Mature-Career	1. For every open leadership position, at least 30% of resumes sourced to be of women candidates (Internal or external). Selection is initiated only after receiving 50% of female candidate resumes. 2. Elimination of the use of historical salary data when making internal and external job offers.	1. Programs to encourage and equip women to take up people management responsibilities 2. Internal sponsorship and mentorship programs focused on skilling of Women in Technology, specifically for senior and middle level women leaders to enhance their technology and leadership skills.	1. MD Connect Series provides an excellent opportunity for women colleagues to network with senior women leaders and Managing Directors in the organisation. 2. Publication of diversity reports for accountability and transparency

4.0 Best Practices

Based on GE & Avtar's research on Women's employment in Manufacturing, Operations and Engineering Services sector in 2021, below are additional best practices collated from different companies:

Schindler India Pvt. Ltd.

Coping with challenges like a high attrition rate and an insufficient talent pool among women, the organization has a targeted recruitment drive to boost women's participation. About 50% of campus hiring is focused on hiring women in the entry-level for roles in the factory. For leadership roles, the talent mapping includes women candidates from the same and allied industries.

Schindler has adopted inclusive policies like work from home, remote working, and day-care facilities for employees. A holistic approach for women employees aims to support expectant mothers with medical assistance during pregnancy, and ensures safe travel amid an inclusive infrastructure.

The talent pipeline of women is being strengthened through upskilling sessions like Open Dialogues, the Female Leadership Development programme for high potential women in individual roles, and the Women in Leadership programme.

A signatory of Women Empowerment Principles (WEPS), Schindler India's diversity, equity, and inclusion vision is 'Winning Through Diversity'. People managers have been trained on the inclusive leadership 'Be An Ally' programme.

The discussions around DEI are all conducted through the year. Alongside an annual inclusion month and recognition of male allies, the Inclusion & Diversity newsletter discusses the success stories of women employees.

KEC International, RPG Enterprises

Countering challenges like insufficient talent pool, lack of resources, and mobility constraints, the organisation has been working towards engaging women in operations, manufacturing, and engineering services. There have been concerted efforts to hire women from tier-1 and tier-2 engineering colleges (IITs/NITs), as part of the Engineering Leadership Trainee (ELT) and Post Graduate Engineering Leadership Trainee (PGELT) program. Through the ELTs, women are hired from local colleges across various countries where KEC has its projects (UAE, Oman, and Uganda). There are Group Management Resource (GMR) programs for MBA graduates from tier-1 city campuses across the country alongside lateral hire from competitors and allied industries

To ensure talent retention, there are targeted events like periodic connect with senior leadership apart from engagement activities planned across the year. These include one-one mentoring sessions by senior leadership, women-friendly policies (flexi hours, maternity, and sabbatical), and Wisdom Quest Policy (which encourages higher studies). For the advancement of women talent, KEC has timely job rotation across locations, departments and roles, and role enlargement for high potential women employees. E-learning modules on technical and behavioral competencies also help them to enhance their capabilities. For top talent among women, the organization offers exposure through external conferences and webinars.

Building an inclusive workplace, the organization conducts regular sessions on gender sensitization, Unconscious Bias, POSH Act, to name a few. Regular meetings with HR-BPs, department heads, and senior leadership help align the goals.

With inclusive rewards and recognition platforms to appreciate the contribution, fun events, and celebrations across festivities, inclusion efforts also comprise

emotional wellness programs in collaboration with Juno Clinic and Practo.

At KEC, male allyship plays a pivotal role in driving inclusion across levels. The focus is on sensitizing senior leadership on the importance of gender diversity with support from the parent company (RPG Group) for diversity hiring.

The organization has periodic and open discussions with leadership and teams to avoid any roadblocks. There is business support in establishing sustainability governance agenda, which focuses on diversity and inclusion.

ABB

ABB is committed to diversity, inclusion, and equal opportunity for business success, and a stronger workforce. The organization strives for a culture where individual differences are welcomed and celebrated. While there are efforts to build the capabilities of the potential women leaders under the RISE program, ABB intends to extend support to meritorious underprivileged women.

Under the program called ‘With Her Beside Her’, a pool of mentors is being created within the organization. A group of young women, which ABB is supporting through an NGO to complete their graduation, will be mentored by the pool. Through this program, the leaders will get a real-time opportunity to interact with the female protégé outside ABB and help them navigate their professional and personal journey. They will also get a chance to learn various aspects of mentoring with specific input on mentoring from ABB and external mentors.

The organization has also initiated managers into a coaching program where trust is built through conversations. ABB also has a male allyship program to bring about a culture of gender equity and inclusion.

Volvo Group India

As a global company, Volvo has been witnessing accelerated growth in India. At the same time, Volvo is looking for opportunities to attract, develop and retain a gender-diverse talent pool.

The company has faced challenges with lower women representation due to gender stereotypes within the workforce, unavailability of women with the required skills for automotive assembly in and around the location, and the flexibility ratio due to the changing demand. The inclusion index based on the internal employee engagement score in the previous year did not match the expectations of the organization.

Assessing the limitations and challenges, opportunities were identified for women, for which unskilled and semiskilled women who were the closest match were selected. A special five-week boot camp ensured the success of this significant initiative. Both men and women were also sensitized to co-working, appreciating diversity, and complementary skill sets.

As a result, there has been an increase in diversity ratio, women technicians on the shop floor, reduction in defect per truck, women technicians were found to cause zero faults, and an increased intake of the program with a mindset shift amongst the male workforce, apart from the efficiency improvements.

To counter the challenge of representation of women in the captive centers, there has been a focus on women hiring. 'ExcelHer', a unique career restart program created exclusively for women and is among the many efforts by the organization to increase diversity in various aspects.

Lean-In circles, a peer-to-peer women networking platform, empowers women to achieve their ambitions and is facilitated by Women colleagues across levels in Volvo Group India.

To reinforce a culture of inclusion for better engagement and retention of the hybrid workforce, the 'Volvo for All' policy aims at creating an inclusive culture to foster supportive energy and encourage individual growth and strong teams. Diversity and Inclusive Leadership Workshops have been conducted for nurturing an inclusive mindset:

For inclusion, the organization has rolled out new benefits, policies, and programs like recognizing the role of equal parenting, increasing paternity leave while birth and adoption to 3 weeks. Male employees, both single and married, can avail themselves of the childcare benefit. The organization also marked the International Men's Day and the International Day of Persons with Disabilities.

Through concerted efforts by the I&D council, HR Leadership, and the Country Management Team members that encouraged the initiatives, the gender diversity ratio has increased by 5%.

Volvo's Country Management Team Members are allies in improving women's representation in the company. In the previous year, 30% of the women talent were appointed as managers, a first in their careers.

The Women in Manufacturing Program devised and managed by the business leader of the Trucks Plant has increased the ratio of women in the plants by 4%.

The organization will soon launch inclusion Labs to increase awareness on gender equality, non-discrimination, and leverage people's potential.

GE Healthcare

With 24% of the total workforce being women, GEHC faces challenges like tight regulations by the government for women in shifts.

A focused initiative called Women in Operations (WIO) under the GE Women's Network (GEWN) aims to employ women in technical, manufacturing, and operational roles. It focuses on women's leadership skills, expanding their networks, building career opportunities, and sharing best practices and experiences. These facilitate the development of women in operations through three main pillars – attract, invest, and grow-- that help to actively retain women talent.

Leadership commitment for inclusion and diversity plays a huge part in the development of women's talent and leaders in the organization. For this, there is a structured operating mechanism consisting of a leadership team, I&D steering committee, employee resource group hubs, and site representatives with active participation across all levels of the organization. GEHC focuses on grooming talent within bottoms up and on lateral hires.

The infusion of women's talent is carried out through programs like GE SCDP (Supply Chain Development Program), and GE GET (Graduate Engineer Trainee) for college freshers. The organization strives to balance the equation by actively hiring competitive women talent for 50% -80% of the SCDP. GEHC is also planning an all-women factory.

Inclusion is fostered through leadership accountability and commitment, building awareness through education and open dialogue, aligning talent and diversity priorities, and strengthening and promoting the culture of belonging

Allyship and advocacy play a key role within the organization. I&D moment sharing, the celebration of talent, and driving the initiatives with people leaders and managers as KPI measured across functions. The affinity group of GEWN and WIO also have male members, and leaders (male and female) are invited to networking events, role model talks, etc.

5.0 Key Recommendations/ Implications/ Call to Action

A career in STEM is a lifelong journey - starting with intent, equipping with relevant skillsets, hopping onto a promising career option, negotiating, and navigating multiple roadblocks and challenges, deviating, or even stepping out temporarily mid-way, resuming the fascinating journey with the right support system, collaborating with other fellow travelers and contributing meaningfully to the world of STEM. For women in STEM, this journey is riddled with additional roadblocks, especially of 3Ms – marriage, maternity, and motherhood. Playing the role of the primary care giver, more so in the Indian context, career pauses and breaks become inevitable at several points of women's careers. However, to consciously include and increase the number of women in STEM careers, the entire ecosystem - the government, academia and industry must make collective efforts. Three "P's" - Policies, Programs and People are critical in order to encourage and enable women to pursue STEM careers. Holistically, this would help determine the vision for the nation, institutionalize and operationalize initiatives towards the vision, leading to impact on the people, who are the core creators

Calls to Action:

For boosting preparedness of women for STEM careers:

- Foster a culture of learning by running libraries with the help of women self-help groups in every pin code of the country
- Enrich the libraries with STEM based books and digital resources for foundational learning
- Conduct sensitization programs on the importance of STEM careers for women at school and college level for all genders along with their parents.
- Through open learning platforms like NPTEL, evangelize the applications of STEM for real world use cases
- Adopt multimodal approach with the use of technologies like virtual reality to make the experience immersive, as well as offer them on browsers such that it can be accessed even with basic electronic devices and minimal data connectivity
- Facilitate interconnectedness between the national chapters of CII and universities to offer industrial visits to serve as inspiration for women to take up STEM careers

- Minimize data access hassles through interoperable central repositories with identification and authentication facilitated via Aadhar
- Promote creativity and problem solving by announcing exclusive challenges and hackathons for women to solve for areas like sustainability using STEM
- Incentivize aspiring startups with a minimum of 50% of women innovators with additional diversity grants via incubators at HEIs
- Provide interest free loans on schemes like Sukanya Samruddhi Yojana for digital empowerment of women in STEM like for purchase of laptops
- Create maker spaces for women in the vicinity of railway stations and post offices across the country, to provide connected and safe zones for entrepreneurial pursuits

To boost recruitment of women in STEM

- Equip women with industry readiness certifications as well as access to technical simulators and sandboxes
- Evangelize and actively promote internship and apprenticeship for women in STEM
- Leverage ICT platforms to create a comprehensive database of women seeking to enter the STEM workforce
- Create separate web-based channels to scout for STEM based women interns
- Collaborate with CII member companies to build a consistent pipeline of opportunities
- Organize recruitment fairs in a hybrid mode on a monthly/bi-monthly basis
- Encourage alumni networks for bonding post career shifts
- Create exclusive portals for career return ships for those on breaks and career pauses
- Inculcate a culture of well-being and propagate an optimistic outlook on career breaks
- Earmark vacancies in organizations for employees returning from career breaks or shifts in career trajectory

- Address career decision conundrums with pragmatic provisions for dual recruitment policies for couples
- Adopt blind hiring practices to shed conscious biases during recruitment
- CII to institutionalize a charter on Women in STEM. Industry to sign the charter for ensuring adequate diversity at workplace in their organisations.

To boost advancement and retention of women in STEM

- Create an inclusive work environment for women in STEM careers, including pay parity and their inclusion in critical organizational decision-making processes
- Mandate flexible working policies and provision of childcare facilities through in-house or partner facilities, or provide allowances for the same
- Promote male allyship as they form a critical part of the support ecosystem
- Nurture Employee Resource Groups in organizations as they help provide a community of support through the growth trajectory of women in STEM
- Promote mentorship, role modelling and shadowing programs
- Create multi-gender sponsor networks within and across organizations to foster trust-based connections for women in STEM
- Increase focus on skill building through open access and proprietary portals
- Accelerate and encourage skill-based promotions devoid of gender bias
- Recognize and reward excellence based on holistic metrics
- Roll out monthly national newsletters on women in STEM featuring role models indicating the impact of their work
- Amplify on social media as well as traditional public media channels
- Mandate news channels and newspapers to allocate airtime and real estate for showcasing the achievements of women

- Akin to initiatives like One Nation One Product, earmark areas for showcasing the creations of women in tech, including frugal innovations and indigenous solution.

To emancipate the quantum of women leaders in STEM at the executive level, CII proposes to run a Women Leaders Cohort. The hybrid mode cohort shall incorporate networking, knowledge sharing and a community based learning approach to obtaining access to C-suites and succeeding in seats of influence

Strong interlinkages and consistent consultative collaborations with a multi stakeholder model, including the government, industry and academia will accelerate the adoption of above listed recommendations, amplify the presence of women in STEM and strengthen their contributions towards nation building.

6.0 Conclusion

In nation-building, the role of women is as important as that of their male counterparts. Although the government of India, private organizations, and academic institutions are coming up with women-centric schemes and policies to enable women's participation across areas of STEM, on a collaborative front, we are yet to cover more grounds. Once all these entities collaborate with full potential to create a STEM-oriented ecosystem comprising growth elements, ideas, and rewards – the results will be more visible.

It is the need of the hour to strive towards a wholly inclusive country that drives prosperity for all. We need to ensure that women get equal importance and visibility while channelizing the resources for STEM participation. As the under-representation and disparity lie in biases, social norms, and stigma, we will have to holistically build an atmosphere to amplify women's exposure, opportunities, and growth in STEM.

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Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government, and civil society, through advisory and consultative processes.

For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. CII engages closely with Government on policy issues and interfaces with thought leaders to enhance efficiency, competitiveness and business opportunities for Industry through a wide portfolio of specialized services and strategic global linkages.

As India completes 75 years of Independence in 2022, it must position itself for global leadership with a long-term vision for India@100 in 2047. The role played by Indian industry will be central to the country's progress and success as a nation. CII, with the Theme for 2022-23 as Beyond India@75: Competitiveness, Growth, Sustainability, Internationalisation has prioritized 7 action points under these 4 sub-themes that will catalyze the journey of the country towards the vision of India@100.

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