

The Role of Technical Education in Enhancing the Participation of Women in India's IT Industry

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Abstract—The rapid expansion of India's Information Technology industry has generated significant employment opportunities, particularly for women, thereby transforming their economic and social statuses. This research investigates the role of technical education in augmenting women's participation in the IT sector and examines its influence on their autonomy, career advancement, and overall economic security. It assesses how access to high-quality technical education, skill development initiatives, and government policies affect women's engagement in the IT industry. Additionally, the study analyses the enrolment in various technical disciplines, the percentage of women employed within the IT sector, and data on female engineering graduates, income levels, and career progression. Such analysis aids in understanding the comprehensive growth of women both personally and professionally. The findings underscore the importance of inclusive policies that facilitate women's access to STEM education and professional development, ultimately fostering gender diversity and economic empowerment within India's IT sector.

Index Terms—Empowerment, Opportunities, Technical Education, Participation

I. INTRODUCTION

The swift expansion of India's Information Technology (IT) industry has created notable employment opportunities, particularly for women. Technical education plays a pivotal role in equipping women with the necessary skills and knowledge to thrive in this sector, thereby improving their financial status. Over the past few decades, India has witnessed a rise in female participation in IT-related education, particularly in computer science, engineering, and information technology programs. This tendency has contributed to the growing representation of women in various IT roles, ranging from software development

and data analysis to project management and leadership positions (NASSCOM, 2023). Despite these advancements, gender divergence persists in terms of access to quality technical education, career progression, and wage disparity. Structural barriers, including socio-cultural norms, limited access to higher education in rural areas, and workplace challenges, continue to hinder women's full participation in the IT industry (World Economic Forum, 2022). Government has developed various schemes such as the "Digital India" program and scholarships for women in STEM (Science, Technology, Engineering, and Mathematics) have played a pivotal role in increasing enrolment in technical education, leading to better employment opportunities for women (Ministry of Education, 2021). This research aims to explore the collision of technical education on the economic empowerment of women in India's IT industry, focusing on important factors such as number of women in technical education, percentage women getting employment opportunities, wage growth, and career mobility ect. By examining existing policies, industry trends, programs, this study will provide insights into how technical education serves as a catalyst for gender inclusivity and economic progress in India's rapidly evolving IT sector.

II. REVIEWS OF LITERATURE

Banerjee and Mukherjee (2020) explore how STEM (Science, Technology, Engineering, and Mathematics) education has promoting reduce the gender pay gap in India's IT industry. This study finds that women with STEM degrees earn nearly 20% more than those with non-technical backgrounds. Gupta and Sharma (2021) Author emphasizes that women with degrees in engineering, computer science, information

technology, and related fields have higher employability rates compared to other courses. This study also notes that skill-based training programs, such as diploma in computer science, coding boot camps and certifications, have further enhanced women's access to IT jobs. Mehta (2018) According to this author women in her work place face various obstacles such as workplace discrimination, lack of mentorship, and work-life balance issues in the technical field. Finally, this research suggests that technical education provides women with the necessary skills and opportunities for improvement of their career growth their economic development. Singh and Reddy (2019) explore the impact of government initiatives, such as the Digital India program and Skill India Mission, in promoting technical education for women. The study also highlights how scholarship programs and coding initiatives have improved the economic status of women in the IT industry.

Research Gap

Despite existing research on technical education's contribution to women's employment in India's IT sector, there is still limited understanding of career advancement, wage development, and how policies affect gender disparities in the workplace. Additionally, socio-cultural and institutional obstacles remain underexplored. This study addresses these gaps by analysing how technical education influences women's involvement in the IT industry in India.

Objectives

1. To examine the status of women in technical education in India.
2. To examine the women's participation rate in the IT (Information Technology) sector in India.
3. To examine the problems and challenges women face in the workplace and the government initiatives aimed at improving women's representation in the IT sector.

III. METHODOLOGY

This study is based on secondary data and examines the "Role of Technical Education in Enhancing the Participation of Women in India's IT Industry". Data has been collected from various sources, including government reports, academic journals, and statistical

databases from organizations such as NASSCOM and the World Bank. The research analyses women's participation in technical education, employment trends, wage disparities, and career progression. It also evolved policy initiatives like Skill India and Digital India that promote women's inclusion in IT. Through inclusivity and trend analysis, the study aims to provide a comprehensive understanding of how technical education influences women's employment status and economic empowerment in the IT sector.

IV. WOMEN IN TECHNICAL EDUCATION

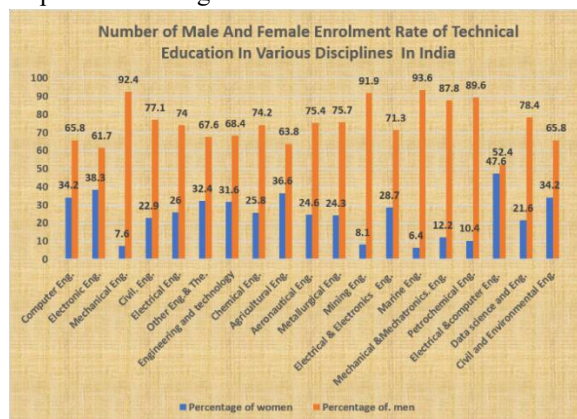
Women's participation in technical education in India has evolved over the years, with representation varying across disciplines. In the 2020-21 academic year, AICTE-approved colleges enrolled 658,191 undergraduate students, of which 30.2% were women. In the 2019-20 academic year, women accounted for 29.2% of students in Bachelor of Engineering and Bachelor of Technology programs. While mechanical engineering has one of the highest undergraduate enrolments, women constitute only 5.9% of its students. Conversely, women are well represented in architecture (52.5%) and electronics engineering (41.7%). According to the All-India Survey on Higher Education (AISHE), computer engineering remains the most popular undergraduate discipline, yet women make up only 34.2% of enrolments. In terms of absolute numbers, electronics engineering has 221,908 female students, while mechanical engineering has 41,462.

Table:1 Number of Male and Female Enrolment Rate of Technical Education in Various Disciplines in India

Discipline	Women	Men	Percentage of women	Percentage of men	Total enrolment in 2021
Computer Eng.	428,335	825,413	34.2	65.8	1,253,748
Electronic Eng.	221,908	357,536	38.3	61.7	579,444
Mechanical Eng.	41,462	502,179	7.6	92.4	543,641
Civil Eng.	96,502	325,350	22.9	77.1	421,852
Electrical Eng.	91,417	260,362	26.0	74.0	351,779

Other Eng.& The.	66,259	138,425	32.4	67.6	204,684
Engineering and technology	35,553	76,966	31.6	68.4	112,519
Chemical Eng.	14,733	42,411	25.8	74.2	57,144
Agricultural Eng.	8,392	14,816	36.6	63.8	23,208
Aeronautical Eng.	4,981	15,277	24.6	75.4	20,259
Metallurgical Eng.	2792	8,678	24.3	75.7	11,470
Mining Eng.	809	9,221	8.1	91.9	10,030
Electrical & Electronics Eng.	2,235	5,554	28.7	71.3	7,789
Marine Eng.	315	5,138	6.4	93.6	5,489
Mechanical & Mechatronics Eng.	143	1,027	12.2	87.8	1,170
Petrochemical Eng.	41	354	10.4	89.6	395
Electrical & computer Eng.	139	153	47.6	52.4	292
Data science and Eng.	45	163	21.6	78.4	208
Civil and Environmental Eng.	27	52	34.2	65.8	79

Source: All India Survey of Higher Education (AISHE) New Delhi, India, Government of India, Department of Higher Education



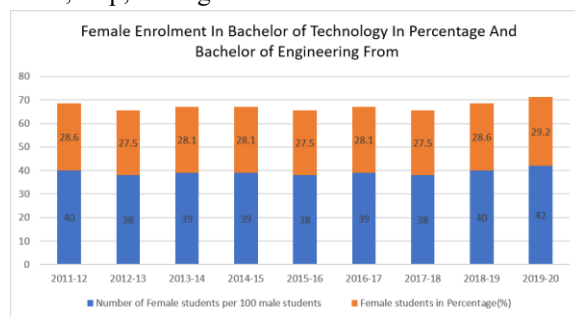
This diagram illustrates the gender distribution in various engineering and technical disciplines in India.

Across most fields, male enrolment significantly outnumbers female enrolment, with women comprising a smaller percentage in nearly all disciplines. Notably, women have higher participation in fields like Computer Engineering and Electronics Engineering, where their enrolment approaches 40%. However, in traditionally male-dominated disciplines such as Mechanical Engineering, Civil Engineering, and Mining Engineering, female enrolment is extremely low, often below 10%. Data Science and Electrical & Computer Engineering show a relatively higher proportion of female students compared to other core engineering fields. This disparity highlights the continued gender gap in technical education, particularly in fields requiring heavy industrial or fieldwork, despite gradual progress in emerging and technology-driven disciplines.

Table:2 Female Enrolment in Bachelor of Technology in Percentage and Bachelor of Engineering From 2011-12 to 2019-20

Year	Number of Female students per 100 male students	Female students in Percentage (%)
2011-12	40	28.6
2012-13	38	27.5
2013-14	39	28.1
2014-15	39	28.1
2015-16	38	27.5
2016-17	39	28.1
2017-18	38	27.5
2018-19	40	28.60
2019-20	42	29.2

Source: MHRD, (2020) All India Survey of Higher Education (AISHE) New Delhi, India Government of India, Dep, Of Higher Education



Above this diagram explores the female students per 100 male students from 2011-12 to 2019-20 shows a fluctuating but slightly increasing trend in gender parity within education. The number of female students per 100 male students ranged between 38 and 42, indicating that for every 100 male students, the

number of female students was consistently lower, averaging around 39. The percentage of female students hovered between 27.5% and 29.2%, showing minor variations over the years. Notably, the highest gender parity was observed in 2019-20, with 42 female students per 100 male students (29.2%). While there is a slight improvement, the data highlights persistent gender disparities in education, suggesting a need for continued efforts to enhance female enrolment and retention in educational institutions.

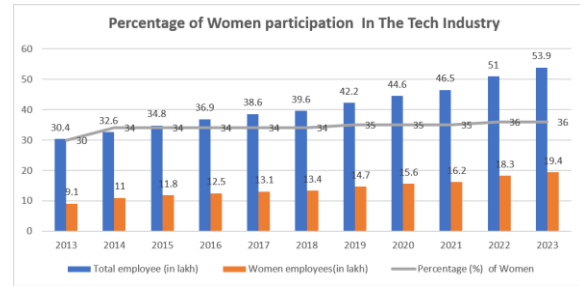
V. WOMEN IN IT (INFORMATION TECHNOLOGY) INDUSTRY

The Indian IT sector has seen a significant rise in women employees, now comprising 36% of the workforce, with over 20 lakh women employed. This growth is driven by progressive policies, increased access to computer science education, women in leadership roles, and policy support for night shifts. Female employment is closely linked to women's empowerment. While India's Female Labour Force Participation Rate (FLFPR) has remained below the global average of 47%, it has been steadily improving. The 2021-22 Periodic Labour Force Survey reported a rise in FLFPR for the 15+ age group to 32.8%, driven by declining fertility rates and expanded education opportunities. As a result, one-third of Indian women are now part of the workforce, marking progress in economic inclusion.

Table 3 Percentage of Women's Participation in the Tech Industry

Year	Total employee (in lakh)	Women employees (in lakh)	Percentage (%) of Women
2013	30.4	9.1	30
2014	32.6	11.0	34
2015	34.8	11.8	34
2016	36.9	12.5	34
2017	38.6	13.1	34
2018	39.6	13.4	34
2019	42.2	14.7	35
2020	44.6	15.6	35
2021	46.5	16.2	35
2022	51.0	18.3	36
2023	53.9	19.4	36

Source: NASSCOM, (National association for software and service companies)- 2023



This above diagram illustrates the growth in total employment and women's participation in India's IT sector from 2013 to 2023. The total number of employees increased consistently from 30.4 lakh in 2013 to 53.9 lakh in 2023. Simultaneously, the number of women employees rose from 9.1 lakh to 19.4 lakh. Despite this growth, the percentage of women in the workforce remained relatively stable, fluctuating between 30% and 36%. A notable rise occurred from 2021 onwards, reaching 36% in 2022 and sustaining that level in 2023. This suggests a gradual but steady improvement in female representation, likely influenced by diversity policies, education advancements, and workplace inclusion initiatives.

VI. CHALLENGES FACED BY WOMEN IN IT SECTOR

Career Advancement and Leadership Roles: While overall participation has increased, women are underrepresented in leadership positions within the IT industry. The gender pays gap remains a concern, with disparities in compensation between male and female employees.

Work-Life Balance: Balancing professional responsibilities with personal and familial obligations remains a significant challenge for many women in the IT sector. This often impacts their career progression and job satisfaction.

Gender Bias and Workplace Culture: Persistent gender biases and a lack of supportive workplace policies can hinder women's professional growth. Issues such as sexism and limited mentorship opportunities contribute to a challenging work environment.

Health Concerns: Women in the IT sector often report physical health issues like eyestrain, back pain, and headaches, as well as mental health challenges, including stress and depression, due to demanding work schedules.

VII. POLICIES AND PROGRAMS IMPLEMENT BY GOVERNMENT

The Indian government has implemented various policies and programs to promote equal opportunities for women in the Information Technology (IT) sector. Key initiatives include:

- National Policy for the Empowerment of Women (2001): This policy aims to advance women's development across sectors by ensuring equal access to education and employment, particularly in science and technology fields.
- PRAGATI (Providing Assistance for Girls Advancement in Technical Education Initiative): Launched by the All-India Council for Technical Education (AICTE), PRAGATI offers scholarships to meritorious female students from families with an annual income below ₹6 lakh, encouraging them to pursue technical education.
- Companies Act, 2013: The Act mandates certain companies to appoint at least one-woman director, promoting female representation in corporate leadership.
- Sexual Harassment of Women at Workplace (Prevention, Prohibition, and Redressal) Act, 2013: This legislation requires organizations to implement measures ensuring a safe working environment for women, crucial for their participation in sectors like IT.
- Mission Shakti: An integrated women empowerment program addressing safety, security, and empowerment, aiming to make women equal partners in nation-building through a participatory approach.

These initiatives reflect the government's commitment to fostering an inclusive environment where women have equal opportunities to thrive in the IT sector.

X. CONCLUSION

Technical education has significantly enhanced the economic status of women in India's IT industry, increasing their participation to 36% of the workforce, with 43% STEM enrolments (AISHE 2022-23, NASSCOM 2023). However, gender disparities persist, with only 18-20% in leadership roles. Women in IT earn 30-40% higher salaries than those in non-technical fields, benefiting from initiatives like Digital

India and Women in Tech. To bridge the leadership gap and ensure sustainable growth, policies promoting skill development, mentorship, and workplace equity are essential. Women employees who are working in IT (information Technology) sector should come up from all the barriers such as the gender wage gap, work-life balance issues, and leadership underrepresentation persist, limiting their full economic potential. Addressing these challenges requires targeted policy interventions, inclusive workplace practices, and continuous investment in technical education and skill enhancement programs.

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