Women in STEM in Bangladesh: Progress, Challenges, and Pathways toward Gender Inclusivity

Ayesha Islam[1] and **Md. Samiul Islam**[1]

Abstract

Despite national progress in women's education, Bangladesh continues to face significant gender disparity in the fields of science, technology, engineering, and mathematics (STEM). This paper investigates the status of women in STEM education and employment using a mixed-method approach, combining secondary data analysis with qualitative insights from a small-scale exploratory survey. National statistics from 2021 to 2023 reveal a gradual increase in female enrollment at the tertiary level. Yet, women's participation remains disproportionately low in engineering and technology universities, where they comprise less than 25% of the student population. Faculty-level data show similar trends, with women comprising less than 30% of university teachers. The survey findings also reveal that young women in STEM face multiple barriers, including a lack of mentorship, societal pressure, and limited institutional support. The paper highlights emerging efforts by academic leaders and organizations like Women in Digital, which are working to improve visibility and inclusion. However, it also underscores the need for stronger institutional and policy implementation. Key recommendations include early exposure to STEM, targeted scholarships, gender-sensitive counseling, inclusive hiring practices, and improved data collection mechanisms. By addressing these gaps, Bangladesh can foster a more inclusive and innovative STEM ecosystem that fully leverages the talents of its female population. This study contributes to the growing literature on gender equity in STEM and offers actionable strategies aligned with national development goals.

Keywords: Women-empowerment, science and technology, development and prosperity, Bangladesh, STEM, gender inclusion

1 Introduction

In the era of the Fourth Industrial Revolution, science, technology, engineering, and mathematics (STEM) are not only the driving forces of innovation but also crucial determinants of sustainable development, economic competitiveness, and social progress. The global landscape of STEM is evolving rapidly, demanding diverse perspectives and inclusive participation. However, a persistent gender gap continues to hinder full inclusivity in STEM fields, especially in developing countries like Bangladesh, where deep-rooted social, cultural, and institutional barriers continue to limit women's access to and retention in scientific and technological domains.

[1] *Department of Computer Science and Engineering, State University of Bangladesh Dhaka, Bangladesh*

Despite significant national efforts to improve access to education for girls in Bangladesh, gender disparities remain particularly evident in higher education and technical professions. Although girls often outperform boys on secondary school exams, this trend does not translate proportionately to enrollment in tertiary STEM programs or to employment in STEM-related fields. Several studies have identified key barriers to women's STEM participation, including gender stereotypes, lack of mentorship, limited institutional support, and inflexible work environments (Ahmed et al., 2020). As Bangladesh aspires to become a digitally advanced and innovation-driven economy, addressing the underrepresentation of women in STEM becomes a strategic necessity.

Historical contributions of pioneering Bangladeshi women in STEM demonstrate that capability is not lacking, but opportunity and encouragement are often missing. There has been very slow and steady progress in female participation in STEM fields. Government policies, non-governmental initiatives, and changing societal perceptions have gradually paved the way for more women to enter STEM fields. However, the current literature and official reports suggest that a comprehensive understanding of both progress and remaining gaps is still underdeveloped.

This work seeks to explore the status, challenges, and possible solutions related to women's participation in STEM in Bangladesh. It adopts a qualitative-descriptive approach that combines secondary data analysis with insights from a small-scale survey conducted among Bangladeshi women with STEM backgrounds. The goal is not to generalize findings, but to present an indicative view of women's experiences and perceptions in STEM education and employment, and to highlight strategic entry points for closing the gender gap in STEM.

1.1 Research Objectives

This study is guided by the following objectives:

- Assess the current participation of women in STEM education and employment in Bangladesh.
- Identify the social, institutional, and personal challenges that hinder women's sustained involvement in STEM fields.
- Explore women's perceptions of STEM careers and the inclusiveness of academic and professional environments.
- Evaluate policy initiatives and propose recommendations for enhancing gender equity in STEM.

1.2 Structure of the Paper

The paper is organized into seven sections. Following this introduction, Section 2 presents related works as well as the historical and contextual background of women

in STEM in Bangladesh. Section 3 outlines the methodology used to collect and analyze data. Section 4 provides an overview of quantitative trends in women's STEM participation using national statistics. Section 5 presents the qualitative findings from the small-scale survey. Section 6 discusses the implications of these findings in light of national policy and institutional practice. Finally, Section 7 concludes with a summary and actionable recommendations.

2 Background and Literature Review

Despite notable advancements in women's education in Bangladesh, a persistent gender gap remains in the fields of science, technology, engineering, and mathematics (STEM). Although female students often outperform males in secondary and higher secondary levels (Hossain & Nasrin, 2018; Rahman, 2023), their participation in university STEM programs is disproportionately low. In 2023, only 22.26% of the students at the Bangladesh University of Engineering and Technology (BUET) were women (Rahman, 2023). This figure is significant, as BUET is considered the top institution for STEM education in Bangladesh. The low number of female students at BUET reflects the broader trend of limited participation of women in STEM nationwide.

2.1 Global and Regional Trends

This underrepresentation is not unique to Bangladesh. Globally, women make up only 33% of researchers and a mere 22% of AI professionals (UNESCO, 2021; World Economic Forum, 2022). South Asian countries such as India and Nepal report similar trends, although Nepal collects more consistent sex-disaggregated data on researchers than Bangladesh (Mehta & Dhadwal, 2023; Islam & Jirattikorn, 2024). The lack of reliable national data in Bangladesh further compounds the issue, making gender-specific policy design difficult (Akhtar, 2023; Rahman, 2023). According to the World Economic Forum, although Bangladesh ranks relatively high in the Global Gender Gap Index for education, this achievement does not extend to STEM inclusion or employment outcomes (World Economic Forum, 2022; Hossain & Nasrin, 2018).

2.2 Cultural and Structural Barriers

Multiple studies have stated that the gender gap in STEM is due to deeply rooted cultural, institutional, and policy-related barriers. Islam and Jirattikorn (2023b, 2024) highlight that female students in Bangladesh often face discouragement from pursuing STEM due to gender stereotypes, societal expectations surrounding marriage, and the lack of female mentors or role models in technical disciplines. Similar conclusions are drawn by Naher et al. (2020) and Naher et al. (2019), who emphasize the role of patriarchal norms and limited mobility in discouraging rural

and urban women alike from choosing STEM careers.

Furthermore, women in academia and research often encounter institutional bias, lack of maternity support, and an absence of clear career advancement opportunities. Choudhury (2019) identifies that, even within higher education, mentorship programs for women are sparse, especially in physics and engineering fields. These barriers result in a "leaky pipeline," where women gradually exit the STEM track at various educational and professional stages.

2.3 Policy Landscape and Gaps

Although the Government of Bangladesh has implemented various gender-focused policies—such as the National Women's Development Policy (2011) and the National Science and Technology Policy (2011)—the execution of these frameworks in STEM contexts has been weak. Studies suggest that these policies lack measurable goals, follow-up mechanisms, and sufficient funding to make systemic changes. According to the World Bank Gender Assessment, while gender parity in basic education has been achieved, STEM-specific strategies such as scholarships, flexible enrollment options, and inclusive hiring are largely absent.

2.4 STEM Role Models and Initiatives

Despite these systemic challenges, several individuals and organizations have made strides in promoting female STEM participation in Bangladesh. Initiatives like "Women in Digital" and mentorship programs spearheaded by female scientists have opened pathways for young women to explore careers in technology and engineering (Islam & Jirattikorn, 2024; Bello et al., 2021). These grassroots and institutional efforts demonstrate that change is possible, but they remain limited in scope and geography.

2.5 Theoretical Insights and Research Gaps

The existing literature strongly supports the application of Amartya Sen's Capability Approach in this context. Access to education alone does not equate to agency or the ability to convert educational opportunities into career outcomes (Mehta & Dhadwal, 2023). The need for structural and cultural support systems is echoed across empirical and theoretical research.

However, gaps remain in understanding the nuanced barriers faced by specific demographics, such as rural women, first-generation university students, and those pursuing emerging technologies like AI and robotics. This paper seeks to fill part of this gap by combining national data with survey-based insights into the lived experiences of Bangladeshi women in STEM.

2.6 Celebrating Women in STEM: Global Contributions

Women have made extraordinary contributions to science and technology throughout history. Ada Lovelace is regarded as the first computer programmer. Grace Hopper developed the COBOL language. Hedy Lamarr's ideas laid the foundation for Wi-Fi and Bluetooth.

NASA's Annie Easley was a rocket scientist. Mary Wilkes designed software for LINC and used a computer at home. Adele Goldberg contributed to GUI design, and Radia Perlman developed the Spanning Tree Protocol, fundamental to the Internet.

Other notable pioneers include Katherine Johnson, who calculated NASA flight paths; Karen Spärck-Jones, who introduced Inverse Document Frequency (IDF); and Elizabeth Feinler, who contributed to the domain name system. Women have also been inventors—Mary Anderson created windshield wipers, and Stephanie Kwolek invented Kevlar.

The Nobel Prizes offer another lens to recognize women's achievements in science. The following tables highlight female Nobel Laureates in Physics, Chemistry, and Physiology/Medicine.

Table 1: Female Scientists Awarded the Nobel Prize in Physics

Name	Contribution	Year
Anne L'Huillier	Experimental methods for attosecond light pulses to study electron dynamics	2023
Andrea Ghez	Discovery of a supermassive object at the galaxy center	2020
Donna Strickland	High-intensity, ultra-short laser pulse generation	2018
Maria Goeppert Mayer	Discoveries concerning nuclear shell structure	1963
Marie Curie	Joint research on radiation phenomena	1903

***(Source:** nobelprize.org)*

Table 2: Female Scientists Awarded the Nobel Prize in Chemistry

Name	Contribution	Year
Carolyn Bertozzi	Development of click chemistry and biorthogonal chemistry	2022
Emmanuelle Charpentier and Jennifer A. Doudna	Development of a method for genome editing (CRISPR)	2020
Frances H. Arnold	Directed evolution of enzymes	2018
Ada E. Yonath	Structure and function of the ribosome	2009
Dorothy Crowfoot Hodgkin	X-ray structure determination of biochemical substances	1964
Ir`ene Joliot-Curie	Synthesis of new radioactive elements	1935
Marie Curie	Discovery and study of radium and polonium	1911

***(Source:** nobelprize.org)*

Table 3: Female Scientists Awarded the Nobel Prize in Physiology or Medicine

Name	Contribution	Year
Katalin Karik´o	mRNA modifications enabling COVID-19 vaccine development	2023
Tu Youyou	Discovery of novel malaria therapy	2015
May-Britt Moser	Discovery of brain's positioning system cells	2014
Elizabeth Blackburn and Carol Greider	Discovery of chromosome protection by telomeres and telomerase	2009
Fran¸coise Barr´e-Sinoussi	Discovery of HIV	2008
Linda B. Buck	Discovery of odorant receptors and olfactory system organization	2004
Christiane Nu¨sslein Volhard	Genetic control of early embryonic development	1995
Gertrude B. Elion	Principles for drug treatment development	1988
Rita Levi-Montalcini	Discovery of growth factors	1986
Barbara McClintock	Discovery of mobile genetic elements	1983
Rosalyn Yalow	Radioimmunoassay of peptide hormones	1977
Gerty Cori	Catalytic conversion of glycogen	1947

***(Source:** nobelprize.org)*

2.7 Celebrating Women in STEM: The Bangladeshi Perspective

This section is dedicated to showcasing the extraordinary achievements and contributions of Bangladeshi women in STEM. Not just as a collective number, we believe Bangladeshi women deserve better recognition for their work in Bangladesh. Bangladesh gained independence as a country in 1971. Women's education was neglected both before and after gaining independence, but women in our country raised their voices for their right to education and participation in society. The first step for them was breaking the societal norms and stigma surrounding girls' higher education, especially women studying STEM fields. Early pioneers Khaleda Shahriar Kabir (Dora), Manowara Begum, and Shirin Sultana (Chumki) did just that. They broke societal norms and decided to study engineering in 1964 at the most prestigious engineering school in East Pakistan – the East Pakistan University of Engineering and Technology, now known as Bangladesh University of Engineering and Technology (BUET). At that time, BUET's architecture department had been admitting female students since 1964, but women were not allowed in any of the other engineering subjects. As the then Vice-Chancellor of BUET, Professor M.A. Rashid was strictly against admitting women. Khaleda Shahriar Kabir (Dora), Manowara Begum, and Shirin Sultana (Chumki) had to face many challenges but did not give up and fought with the authority for their right to study in any engineering stream, and they succeeded. Khaleda Shahriar Kabir (Dora) and Shirin Sultana (Chumki) graduated with Civil Engineering degrees, and Manowara Begum graduated with a Chemical Engineering degree from BUET. Their significant and courageous steps have motivated many women, as we now see that BUET has 21.25% female students.

On the other hand, Zohra Begum Kazi is the first Bengali Muslim woman to become a doctor. She is a renowned person known for her extraordinary achievements and awards from three different countries. She was awarded the Viceroy's Medal by the British Indian government in 1935, the Tamgha-e-Pakistan by the Pakistan government in 1964, and the Ekushey Padak posthumously by the Bangladeshi government in 2008. She was born in 1912 and came from a wealthy family; her father was a well-known politician and physician, which laid the groundwork for her to become a woman physician at a time when women's education was taboo and not broadly discussed. She inspired generations of women and became one of the most well-known and renowned women pioneers.

Madhabi Islam is another well-known early woman pioneer who is known for leading the Atomic Energy Commission. Dr. Madhabi Islam started working in the Bangladesh Atomic Energy Commission (BAEC) in the early 1980s, when only a handful of women worked there. As not many female students studied engineering, there weren't that many female employees. When Dr. Madhabi Islam joined BAEC, the projection started changing. During her time, she witnessed significant progress of women employees, and she also supervised many women under her wing. Many women were inspired by her work ethic and diligence.

In recent years, many notable women are contributing in STEM in many ways, one of which is by offering training and support. Achia Khaleda Nila is a well-known figure. In 2013, she founded "Women in Digital (WID)," a social enterprise. Through WID, she helps female creators who want to work on digital platforms. WID now operates an agency, tech schools, and an e-commerce initiative. Female engineers of the agency work on IT products for both national and international clients. So far, they have built more than 6,000 websites and 3,000 mobile applications. Women in Digital is undoubtedly of significant help in inspiring women to work in the tech industry. They work to elevate women's confidence in the industry.

Dr. Samia Subrina, Dr. Jennifer Doudna, Dr. Nina Tandon, Dr. Nova Ahmed, Syeda Sadia Hossain, Samia Tasnim, Ananya Ferdous Hoque, and Nazia Tjrian Amin are some notable Bangladeshi women in STEM who are proudly contributing to the field, changing the landscape, and paving the way for the next generation of women in the field.

Table 4: Bangladeshi Female Scientists Receiving International Awards

Name	Award(s)	Year(s)
Dr. Gawsia Wahidunnessa Chowdhury	Best and Brightest 100 Asian Scientists	2023
Dr. Senjuti Saha	Best and Brightest 100 Asian Scientists	2023
Dr. Firdausi Quairi	Best and Brightest 100 Asian Scientists	2021
Salma Sultana	Best and Brightest 100 Asian Scientists; Norman E. Borlaug Award	2021, 2020
Dr. Samia Subrina	Best and Brightest 100 Asian Scientists; OWSD-Elsevier Foundation Award	2021, 2020

(Source:** Asian Scientist Magazine**)

3 Methodology

This study adopts a qualitative-descriptive approach that integrates secondary data analysis with a small-scale exploratory survey. The goal is to understand the current status, challenges, and opportunities related to women's participation in STEM fields in Bangladesh.

3.1 Data Sources

The study relies on both primary and secondary data:

- **Secondary data** were gathered from a range of official and institutional sources, including:
  - Bangladesh Education Statistics (2021–2023), published by the Bangladesh Bureau of Educational Information and Statistics (BANBEIS)
  - University Grants Commission (UGC) annual reports
  - UNESCO Institute of Statistics
  - Global Gender Gap Reports (2022, 2023)
  - Peer-reviewed academic journals and news articles
- **Primary data** were collected through a short, anonymous online survey distributed to women in Bangladesh with experience in STEM education or employment.

3.2 Survey Design and Sample

The survey aimed to collect qualitative insights on women's academic and professional experiences in STEM. The questionnaire included both multiple-choice and open-ended questions covering topics such as:

- Academic background and transitions from STEM to non-STEM fields
- Perceived challenges during STEM studies or employment
- Opinions on workplace inclusion, harassment, and gender equity
- Suggestions for policy improvements and retention strategies

A total of 30 participants responded to the survey. The majority were university students or recent graduates in their 20s to 30s. Responses were collected via Google Forms and analyzed manually to identify recurring themes and qualitative trends. No personally identifying information was used in the analysis or included in the paper to ensure respondent anonymity and ethical compliance.

3.3 Analytical Approach

Given the small sample size and exploratory nature of the research, the survey findings were analyzed thematically rather than statistically. Responses were grouped into common categories (e.g., barriers to participation, career perceptions, policy suggestions) and discussed in relation to existing literature and secondary data trends.

3.4 Triangulation and Limitations

To enhance reliability and context, the study uses triangulation by cross-referencing:

- Official statistical data
- Personal experiences gathered through the survey
- Literature reviews and documented success stories

However, several limitations must be acknowledged:

- The survey was based on a non-random, convenience sample and may not represent the broader female population in Bangladesh.
- Many respondents were students rather than working professionals, leading to an underrepresentation of workplace-specific issues.
- Some survey questions, especially on sensitive topics like harassment, were skipped by respondents, limiting analytical depth.

Despite these limitations, the combination of qualitative and quantitative data offers a well-rounded, indicative view of the state of women in STEM in Bangladesh and helps identify potential areas for policy intervention and institutional reform.

4 Data Analysis

Data shows that in 2017, 32.57% of the students were female among all the public universities. Now, if we look at more recent data, then it is clear that the number is increasing, not drastically rather slowly but steadily. Compared to the time when female education was a taboo in a country like Bangladesh, the rising percentage of female students in both public and private universities is slowly changing as more women are given the freedom of choice and much national and international aid for their education. As universities represent the highest education level in a country, analyzing the data from the past year to recent times gives us a clear picture of women's participation in education. Seats in public universities are limited, and the competition is high; participation is open to both sexes. Public universities offer a wide range of study majors; on the other hand, private universities mostly offer

business or humanities-related majors and very few science majors.

The data reveals a significant drop in female representation as we move from primary to higher education, especially in STEM-related university programs. Table 5 shows that while girls make up more than half of the student body in secondary 54.67% and higher secondary 51.89% levels, the number drastically falls to 36.30% at the university level. This suggests that the transition barrier to tertiary education, particularly in STEM, is not due to academic capability but rather systemic factors such as social expectations, financial constraints, or institutional barriers.

Table 5: At a Glance Number of Female Students in Different Education Levels

Education Level	Female Students (%)
Primary Education	49.50
Secondary Education	54.67
Higher Secondary Education	51.89
University Level	36.30

***(Source:** Bangladesh Education Statistics)*

Public universities (Table 6) fare slightly better than private universities in female representation—41.03% vs. 29.72% in 2023. While public institutions are more affordable and accessible to female students, the lower percentage in private institutions may reflect curricular limitations, tuition fees, or safety and mobility concerns for women. However, the increase from 2021 to 2023—about 2.3% in public and 0.06% in private universities—suggests a slow but positive trend, possibly influenced by awareness campaigns, quota systems, or mentorship programs.

Table 6: Number of Students in Universities by Gender in Bangladesh (2023)

University Type	No. of Univ.	Male	Female	Female (%)	Total
Public	55	428,131	297,840	41.03	725,971
Private	114	238,464	100,841	29.72	339,305

***(Source:** Bangladesh Education Statistics 2023)*

Teacher representation (Table 9) highlights another gap. From 2021 to 2023, the percentage of female faculty in public universities remained below 28%, while private universities had a slightly better ratio of around 31%. This lack of female academic leadership may

Table 7: Number of Students in Universities by Gender in Bangladesh (2022)

University Type	No. of Univ.	Male	Female	Female (%)	Total
Public	53	428,523	291,856	40.51	720,379
Private	109	215,090	95,017	30.64	310,107

***(Source:** Bangladesh Education Statistics 2022)*

Table 8: Number of Students in Universities by Gender in Bangladesh (2021)

University Type	No. of Univ.	Male	Female	Female (%)	Total
Public	50	552,510	348,999	38.71	901,509
Private	108	231,185	97,504	29.66	328,689

***(Source:** Bangladesh Education Statistics 2021)*

limit mentorship opportunities and discourage female students from envisioning themselves in long-term STEM careers. Table 10 to Table 12 reveal a concentration of female faculty in a few institutions, such as Jagannath University (41%), while premier technical institutions like BUET and Islamic University still show very low representation (15–17%). This indicates that women in STEM academia are clustered in less technical fields or institutions, underscoring discipline-based segregation in higher education.

Table 9: Number of Teachers in Universities by Gender in Bangladesh

Year	Public Teachers	Women (%)	Private Teachers	Women (%)	Public Univ.	Private Univ.	Total Univ.
2023	16,399	27.25	16,245	31.22	55	114	169
2022	15,236	27.74	15,390	32.08	53	109	162
2021	15,426	26.73	15,277	32.20	108	108	158

***(Source:** Bangladesh Education Statistics)*

Table 10: Female Teachers in Public Universities (2023)

SI	University	Women	Total	Women (%)
1	BUET	121	764	15.84
2	DU	734	2,299	31.93
3	JU	275	833	33.01
4	BAU	201	665	30.23
5	RU	225	1,081	20.81
6	CU	367	1,510	24.30
7	SUST	134	566	23.67
8	Khulna Univ.	132	523	25.24
9	Jagannath Univ.	278	671	41.43
10	Islamic Univ.	69	406	17.00

***(Source:** UGC Bangladesh 2023)*

Table 11: Female Teachers in Public Universities (2022)

SI	University	Women	Total	Women (%)
1	BUET	174	722	24.10
2	DU	733	2,311	31.72
3	JU	250	764	32.72
4	BAU	162	567	28.57
5	RU	265	1,108	23.92
6	CU	250	1,008	24.80
7	SUST	134	562	24.02
8	Khulna Univ.	125	503	24.85
9	Jagannath Univ.	279	678	41.15
10	Islamic Univ.	64	392	16.33

***(Source:** UGC 2022)*

Table 12: Female Teachers in Public Universities (2021)

SI	University	Women	Total	Women (%)
1	BUET	758	2,421	31.31
2	DU	734	2,299	31.93
3	JU	233	757	30.78
4	BAU	164	591	27.75
5	RU	237	1,097	31.60
6	CU	287	1,289	22.27
7	SUST	132	561	23.53
8	Khulna University	125	507	24.65
9	Jagannath University	291	695	41.87
10	Islamic University	32	398	15.58

***(Source:** UGC 2021)*

In Bangladesh, there are several engineering and technology universities. In these universities, STEM majors top the list; therefore, the number of female students in these institutions is worth noting. As shown in Table 11 in 2023, the number of female students in most engineering and technology fields was below 25%. BUET has the highest number here at 22.26% but still the numbers are not satisfactory as we aim to keep the male to female student ratio 50:50.

Most strikingly, the engineering universities (Tables 13–15), which are key to STEM development, have persistently low female student ratios, ranging from 18.5% to 22.5% between 2021 and 2023. This points to a critical bottleneck in STEM participation despite broader gains in education. The stagnant figures suggest that gender stereotypes, lack of preparation in school, or absence of targeted outreach programs are preventing a balanced intake in engineering disciplines.

This trend also corresponds with the low number of women in technical teaching roles, creating a reinforcing cycle: fewer female students → fewer female graduates → fewer women in academia → fewer mentors and role models → continued low enrollment.

Table 13: Number of Female Students in Public Engineering Universities in 2023

SI	Name of University	Total Students	Female Students	Female (%)
1	Bangladesh University of Engineering Technology (BUET)	7,420	1,352	22.26
2	Rajshahi University of Engineering and Technology	6,376	1,338	20.98
3	Khulna University of Engineering & Technology	7,941	1,579	19.88
4	Chittagong University of Engineering & Technology	5,574	1,203	21.58

***(Source:** UGC 2023)*

Table 14: Number of Female Students in Public Engineering Universities in 2022

SI	Name of University	Total Students	Female Students	Female (%)
1	Bangladesh University of Engineering Technology (BUET)	6,959	1,558	22.39
2	Rajshahi University of Engineering and Technology	5,928	1,334	22.50
3	Khulna University of Engineering & Technology	6,359	1,180	18.56
4	Chittagong University of Engineering & Technology	6,185	1,314	21.24

***(Source:** UGC 2022)*

Table 15: Number of Female Students in Public Engineering Universities in 2021

SI	Name of University	Total Students	Female Students	Female (%)
1	Bangladesh University of Engineering Technology (BUET)	8,851	1,881	21.25
2	Rajshahi University of Engineering and Technology	5,809	1,309	22.53
3	Khulna University of Engineering & Technology	5,950	1,103	18.54
4	Chittagong University of Engineering & Technology	5,954	1,202	20.19

***(Source:** UGC 2021)*

Figure 1 shows the number of students by gender in public universities from the year 2012-2023, and it is clear that the number of female students has increased over the past years but it's still not equal to male students. Last year, we saw that the number was higher than in past years. Although it's not a drastic change in numbers rather a

steady growth. The graph shows participation in all fields of study, not just STEM; therefore, we see that the number of female students in STEM is still below 30%. Although Bangladesh ranks relatively high among South Asian countries in the Global Gender Gap Index, with an improved score of 0.722 in 2023 (ranked 59th globally), this does not necessarily translate to gender equality in STEM participation. Compared to neighbors like India (ranked 127th), Pakistan (142nd), and Nepal (116th), Bangladesh shows better overall gender equity. However, its gains are mostly concentrated in political empowerment and basic education, while gaps remain in.

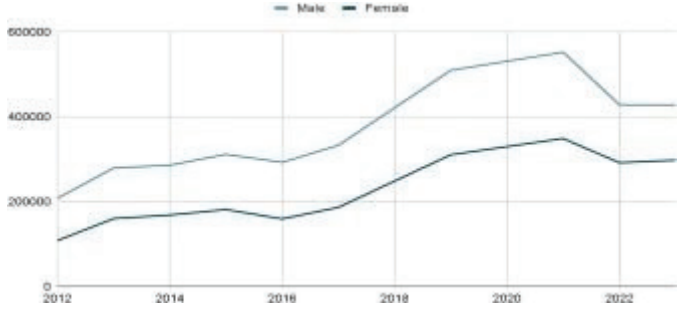

Figure 1: Number of students by gender in the Public Universities from 2012-2023

(Source:** Bangladesh Education Statistics**)

STEM education and workforce participation. Countries like Bhutan, despite lower previous rankings, have made significant improvements (moving up from 126 to 103), indicating focused gender policy interventions. The overall trend in South Asia reflects a disconnect between educational access and career opportunities, especially in male-dominated fields like engineering and technology. Bangladesh must now convert its gender equity gains into tangible outcomes in STEM through targeted programs, female leadership, and inclusive policy design.

Table 16: Gender Gap Index, 2022 and 2023

Country	2022 Rank	2022 Score	2023 Rank	2023 Score
Bangladesh	71	0.714	59	0.722
India	135	0.629	127	0.643
Sri Lanka	110	0.670	115	0.663
Nepal	96	0.692	116	0.659
Maldives	117	0.648	124	0.649
Bhutan	126	0.637	103	0.682
Pakistan	145	0.564	142	0.575

(Source:** Global Gender Gap Report 2022 and 2023, World Economic Forum**)

5 Survey Findings

To complement the secondary data and literature review, a small-scale exploratory survey was conducted among Bangladeshi women with academic backgrounds in STEM. While the sample size was limited, the insights gathered provide indicative trends regarding women's experiences, perceptions, and challenges in STEM education and related careers.

5.1 Respondent Profile

The majority of respondents were aged between 21 and 35 years, and most currently reside in the Dhaka division. Nearly all participants had studied science during their school and college years. At the time of the survey, several respondents were pursuing STEM subjects at the university level, while others had transitioned to non-STEM fields.

5.2 Academic Pathways and Shifts

Respondents were asked to describe their educational trajectory in STEM. About 31% of the participants were currently enrolled in STEM programs at the university level. However, a significant number had shifted to non-STEM disciplines such as business or humanities during higher education.

The main reasons cited for this shift included:

- Interest changes post-college.
- Family or societal pressure to pursue more "secure" or gender-acceptable fields.
- Perceived difficulty of STEM subjects compared to other disciplines.

This suggests that while initial interest in science is high, maintaining long-term engagement in STEM remains a challenge for many women.

5.3 Challenges in STEM Education

Participants identified multiple challenges they encountered during their academic journey:

- Difficulty in balancing STEM coursework with family or personal responsibilities.
- Lack of confidence in technical abilities.
- Limited presence of female mentors and role models.

Most respondents did not report harassment or insecurity in academic settings, though several skipped this question, possibly indicating discomfort with disclosure.

5.4 Perception of STEM Careers

When asked whether STEM fields in Bangladesh are welcoming to women:

- 70% of respondents felt STEM careers are "somewhat welcoming but still challenging."
- No respondent indicated that STEM careers are completely unwelcoming. This suggests a cautiously optimistic outlook, despite persistent challenges.

5.5 Retention and Encouragement

Respondents provided insights on what might encourage more women to pursue and remain in STEM careers:

- 48% recommended more career guidance in schools and colleges.
- Others emphasized better job opportunities and flexible work policies.
- The presence of visible female mentors and role models was also seen as critical.

5.6 Policy Recommendations from Respondents

Participants proposed several policy actions to increase women's participation in STEM:

- More scholarships and financial aid for women in STEM fields.
- Gender-equal hiring and promotion policies in workplaces.
- Women-focused STEM training programs, especially in digital technologies and emerging sectors.

5.7 Limitations

This survey represents preliminary qualitative insights based on a limited and non-representative sample. Most respondents were current students rather than professionals, which may bias the data toward academic experiences. Additionally, incomplete responses-especially on sensitive topics-limit the depth of analysis. The results should be interpreted as exploratory and not conclusive.

6 Results and Discussion

This section interprets the trends and insights drawn from both secondary data and the small-scale survey conducted for this study. The goal is to understand the trajectory of female participation in STEM fields in Bangladesh and discuss the key barriers and enablers that shape this landscape. While the data reveal incremental progress, they also expose persistent structural challenges that require targeted policy responses.

6.1 Enrollment Trends: Slow but Consistent Growth

The longitudinal data (2021–2023) indicate a modest upward trend in female enrollment in both public and private universities in Bangladesh. In 2023, women constituted 41.03% of students in public universities and 29.72% in private universities. Although these figures represent progress compared to previous years, they remain far from gender parity. Notably, the drop-off from higher secondary to tertiary education (from 51.89% to 36.30%) highlights a critical transition point where many young women opt out of or are excluded from pursuing further studies.

The situation is more concerning in engineering and technology universities, where the proportion of female students remains below 25%. This suggests that even when women access tertiary education, they are still less likely to pursue technical disciplines — the core of STEM. These findings support earlier research indicating that social norms, gender stereotypes, and a lack of preparatory support discourage women from selecting science and engineering as their fields of study.

6.2 Faculty Representation: Leadership Gap in Academia

Faculty-level data show that women remain significantly underrepresented among university teachers. In 2023, only 27.25% of teachers in public universities and 31.22% in private universities were women. This shortage of female academic role models likely contributes to the persistence of male-dominated academic spaces, which can affect female student retention and motivation. Despite national policy commitments to gender equality, university hiring patterns have not yet achieved a meaningful balance.

6.3 Institutional Variation and Pockets of Excellence

While overall progress is uneven, a few institutions demonstrate relatively higher female participation. Jagannath University, for example, reported over 41% female faculty in 2023, a rare exception in the public sector. Similarly, private universities like BRAC and NSU have female student populations approaching parity. These examples suggest that institutional leadership and culture may play a critical role in shaping inclusivity.

6.4 Survey Insights: Experiences and Perceptions

Survey responses provide a valuable qualitative supplement to the national data. A majority of respondents (31%) were enrolled in STEM programs, but a significant number had shifted to non-STEM disciplines due to personal interest, family pressure, or perceived academic difficulty. The most frequently cited challenges included:

- Lack of confidence and self-efficacy in STEM subjects
- Limited access to female mentors or support networks
- Pressure to prioritize marriage or caregiving over career

Additionally, while 70% of participants described STEM as "somewhat welcoming," many still perceived it as a challenging environment for women. Very few were employed in STEM fields, indicating a retention issue that goes beyond academic entry.

6.5 Policy Gaps and Missed Opportunities

The data suggest that although policy frameworks such as the National Women Development Policy (2011) and National Science and Technology Policy (2011) emphasize gender equality, their implementation in STEM education and employment remains weak. There is a lack of targeted scholarships, flexible institutional structures, and systematic mentoring for women in technical fields.

Moreover, Bangladesh's absence from global datasets on gender-disaggregated research professionals (as noted by UNESCO) further hampers efforts to evaluate and improve the situation. Improved data collection practices would allow for more evidence-based policy interventions.

6.6 A Positive but Cautious Outlook

Despite these barriers, there are encouraging signs. Initiatives like Women in Digital, along with the increasing visibility of female scientists and engineers, offer role models and create inclusive ecosystems. Bangladesh's relatively strong performance in the Global Gender Gap Index - ranking ahead of most South Asian countries - indicates a supportive policy environment that can be leveraged more effectively for STEM.

The evidence points toward a trajectory of slow but steady progress. However, without structural reform and deliberate action, the gender gap in STEM will remain a long-term issue.

6.7 Summary of Key Findings

- Female participation in general higher education is improving, but remains low in STEM fields.
- Engineering and technology universities have the most pronounced gender gaps.
- Women are significantly underrepresented in faculty positions.
- Social and institutional barriers - not lack of interest - are the primary obstacles.
- Targeted interventions in policy, mentorship, and institutional culture are essential.

7 Conclusion and Recommendations

7.1 Conclusion

This study has explored the multifaceted challenges and opportunities surrounding women's participation in STEM education and employment in Bangladesh. Drawing from national statistics, institutional data, and a small-scale exploratory survey, the findings highlight both progress and persistent barriers in the journey toward gender equity in science and technology. While female enrollment in general higher education has steadily improved, women's representation in STEM fields—particularly engineering and technology—remains significantly low. Institutional data reveal a consistent underrepresentation of female students and faculty across most public universities, especially those with a STEM focus. Survey insights further indicate that women face numerous personal, social, and institutional challenges, including limited mentorship, low self-confidence, and societal expectations around gender roles.

Despite these challenges, the outlook is cautiously optimistic. Bangladesh has achieved relatively strong regional rankings in gender equality and is home to many pioneering women who are actively reshaping the STEM landscape. Organizations such as Women in Digital and the growing visibility of female academics and professionals signal positive cultural shifts. However, without stronger policy implementation, increased investment in support structures, and widespread institutional reform, these advances will remain limited. Gender inclusion in STEM must be reframed not only as a matter of equity but also as a national imperative for innovation, economic growth, and sustainable development.

7.2 Recommendations

Based on the data and analysis, the following recommendations are proposed to support and expand women's participation in STEM in Bangladesh:

- **Introduce Early STEM Exposure:** Promote STEM-related activities, competitions, and awareness campaigns at the primary and secondary school levels to spark interest among girls.
- **Targeted Scholarships and Financial Aid:** Develop government- and university- sponsored financial support programs specifically for women pursuing STEM degrees, particularly in engineering and technology.
- **Strengthen Career Counseling:** Provide gender-sensitive academic and career counseling services in schools and colleges to guide girls toward STEM careers.
- **Mentorship and Networking Programs:** Establish mentorship programs connecting female students with women professionals and researchers in

STEM fields.

- **Institutional Reforms:** Encourage universities to review admission policies, hiring practices, and campus cultures to ensure a gender-inclusive academic environment.
- **Inclusive Workplaces:** Promote flexible work policies, maternity benefits, and harassment- free environments to improve the retention of women in STEM careers.
- **Visibility of Role Models:** Use media, public events, and academic campaigns to highlight the achievements of successful Bangladeshi women in STEM to inspire the next generation.
- **Data Collection and Monitoring:** Mandate sex-disaggregated data collection in research and academia to enable policy-makers to track progress and plan effectively.
- **Encourage Female-led Tech Entrepreneurship:** Support women in launching startups and leading tech initiatives through dedicated incubators, training, and funding.

Addressing the gender gap in STEM is essential not only for achieving gender justice but also for ensuring that Bangladesh fully benefits from the creativity, intellect, and innovation of its entire population.

References

Ahmed, N., Urmi, T., & Tasmin, S. (2020). Impact of socio-economic factors on female students' enrollments in STEM, and workplace challenges in Bangladesh. European Journal of Education and Training. https://www.researchgate.net/publication/340824943

Bangladesh Bureau of Educational Information and Statistics (BANBEIS). (2023). Bangladesh education statistics 2023. Ministry of Education. http://data.banbeis.gov.bd/

Bello, A., Blowers, T., Schneegans, S., & Straza, T. (2021). To be smart, the digital revolution will need to be inclusive. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000375429

Choudhury, S. (2019). Initiatives for mentoring women pursuing physics education and careers in Bangladesh. AIP Conference Proceedings, 2109, 050006. https://doi.org/10.1063/1.5110080

Helvaci, S., & Helvaci, İ. (2019). An interdisciplinary environmental education approach: Determining the effects of E-STEM activity on environmental awareness. Universal Journal of Educational Research, 7(2), 337–346. https://doi.org/10.13189/ujer.2019.070205

Intellectual Property Office (UK). (2019). Gender profiles in worldwide patenting: An analysis of female inventorship (2019 edition) https://www.gov.uk/government/publications/gender-profiles-in-worldwide-patenting-2019-edition

Islam, M. M., & Jirattikorn, A. (2023a). Breaking gender barriers in STEM education for achieving the SDG of quality education in Bangladesh. Development in Practice, 34(1), 129–135. https://doi.org/10.1080/09614524.2023.2229965

Islam, M. M., & Jirattikorn, A. (2023b). Women in STEM: Where does Bangladesh stand? Asian Journal of Gender and Development. https://www.researchgate.net/publication/365603791

Islam, M. M., & Jirattikorn, A. (2024). Bridging the gap: Examining institutional barriers to women in STEM in Bangladesh. Science, Technology and Society. https://doi.org/10.1007/s44217-024-00185-9

Koenig, L., Smith, J., & Patel, A. (2021). Women in engineering: Current statistics and barriers. American Sociological Review. https://doi.org/10.1177/00027642221078517

Lina, N. A. (2023). The growth of women's education in Bangladesh. American Journal of Education and Technology, 2(3), 40–50. https://doi.org/10.54536/ajet.v2i3.1276

Mehta, B., & Dhadwal, S. (2023). Mind the gap: Policy, discourse and status of women in STEM in South Asia. Centre for Civil Society. https://www.researchgate.net/publication/374702431

Moyeen, S., Lonnberg, A. T., Akter, M., Chowdhury, S., Parvin, S., Sethi, J., Suwal, E. S., Tazrin, M. R., & Zaman, S. I. (2021). Bangladesh country gender assessment. World Bank.

https://documents.worldbank.org/en/publication/documents-reports/documentdetail/891731636231256102

Naher, H., Tanim, T., & Sultana, N. (2019). Women in science and technology: A study in Bangladesh. Sociology and Anthropology, 7(7), 306–312. https://doi.org/10.13189/sa.2019.070702

Naher, M., Rana, M., Siddika, A., Akter, S., & Islam, S. (2020). Women and sustainable development: Bangladesh perspective. IOSR Journal of Humanities and Social Science, 25(6), 8–18. https://doi.org/10.9790/0837-2506110818

Nasrin, S. (2019). Barriers to STEM education for rural girls. Brookings Institution. https://files.eric.ed.gov/fulltext/ED602920.pdf

Sharma, P., & Bhandari, R. (2021). Gendered dimensions of digital skills: Evidence from South Asia. IEEE Access. https://doi.org/10.1109/ACCESS.2021.9368378

Siddiqa, N. (2019, October 11). Beyond labs and numbers: STEM's role in girls' skills development in Bangladesh. Brookings. https://www.brookings.edu/articles/beyond-labs-and-numbers-stems-role-in-girls-skills-development-in-bangladesh/

UNESCO. (2024). Call to action: Closing the gender gap in science (SC-PBS-STIP/2024/FWIS/1 Rev.2). https://unesdoc.unesco.org/ark:/48223/pf0000381348

UNESCO Institute for Statistics. (2024). Women in science. https://uis.unesco.org/en/topic/women-science

World Economic Forum. (2023). Global Gender Gap Report 2023. https://www.weforum.org/reports/global-gender-gap-report-2023

World Economic Forum. (2024, March 19). Equity, diversity and inclusion: Women inventors make gains, but gender gap remains https://www.weforum.org/agenda/2024/03/women-inventors-gender-gap-patents-diversity/