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Women's Participation and Factors Affecting Their Academic Performance in Engineering and Technology Education: A Study of Ethiopia

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Abstract: Academic performance is one of the reasons for gender imbalance in STEM education. This study has two objectives: analyzing women's participation in STEM education and investigating the factors affecting women's achievements in Engineering and Technology university majors in Ethiopia. Secondary data have been analyzed to establish women's involvement in STEM education using enrollment and graduation data and to observe the gender gap. Primary data were collected from 376 women students of engineering and technology. The OLS multiple regression model results reveal that the academic performance of women in engineering and technology education is positively influenced by students' capabilities to gather information about the institution before joining the university. Interventions followed by institutions for supporting women students, peer learning habits of students, and the accessibility of university infrastructure also positively affect women's academic performance. In contrast, sexual harassment and the existence of engineering and technology professionals in the family negatively influence the academic performance of women. Hence, educational organizations, governments, and other stakeholders should work to enhance women's academic performance and reduce the gender gap in STEM education. Engineering colleges must also give attention to students' psychological, economic, and educational support, try to fulfill infrastructure and learning equipment, and protect students from sexual harassment through strong commitment and regulations.

Keywords: women's academic performance; engineering and technology education; Ethiopia

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1. Introduction

As the technological intensity domains have increased in recent years, developing human capital in engineering and technology has become an essential aspect of sustainable development. The Agenda of Sustainable Development Goals adopted by the United Nations in 2015 includes sustainable development Goals (SDGs) four on quality education, five on gender equality, and ten on reduced inequality within and among countries [1]. These goals emphasize the importance of increasing opportunities for progress and promoting individuals, families, and communities to ensure sustainable development and improve all human beings' living standards [2]. As Sustainable Development Goals (SDGs) four and five focused on quality education and gender equality such that many developed and developing countries always consider education a crucial tool in their development. Being a developing country, Ethiopia needs many projects, such as road and housing constructions, building manufacturing factories, etc. The government, therefore, requires highly qualified professionals in engineering and technology [3]. As a result, it is necessary to produce students with high academic performance, including women, to reduce the gender gap in STEM education [4], and women have to be encouraged to increase individual and national income [5]. However, women's education in Science, Technology, Engineering, and Mathematics (STEM) has demonstrated gender gaps, and low representation of women in STEM is universally acknowledged due to a lack of recognition of achievements and fewer promotions [6].

1.1. Women's Participation in STEM Education

The education of females contributes to various aspects of their lives, such as increased longevity, family health, and nutrition. In Ethiopia, women's education was strongly influenced by socio-cultural norms and attitudes, leading to a minimum share of women in higher education and STEM fields. Singh and Sarah have grouped all the countries of the world into four groups to discuss women's participation, based on the similarity of characteristics, and found that Ethiopia falls in the fourth group, which comprises developing countries with traditionally low participation of women in engineering education; however, recently, participation has increased [7].

In another paper [8], Mahajan found that STEM education is male-dominated in other countries of the world. Engineering is considered a male profession, and women's participation is low. He also discussed the reasons for this, such as gender stereotypes, social and cultural values of the society, women's educational background in science subjects, lack of role models, and women undermining the perception of employer companies. Women are usually under-represented in the academic and professional fields of engineering and technology, even though many of them have greatly contributed once they have joined the area [8,9].

A study by Sikora and Pokropek [10] investigated the existence of gender difference in computing, engineering, and mathematics by using survey data from 50 countries. Their findings shows that males are more interested in engaging in these fields than their female counterpart. The idea is also supported by a study [11] which found that only 18% of women who are students in higher education institutions throughout the world pursue STEM fields compared to 35% of men. A study by Botella et al. [12] discussed the problems of gender gaps in Spain in STEM education. They argued that institutional encouragement and support, increasing the professional support network, promoting and supporting leadership, and increasing female role models' feasibility could encourage women in STEM education. These instruments could increase the percentage of graduated female students from information and communications technology studies.

Rodríguez-Rivero et al. [13] also found the existence of gender gaps in STEM education in Spain, that 24.8% women are enrolled in undergraduate engineering and architecture field of study in 2018–2019, whereas 75.2% are men. The same is happening in Master's and Ph.D degree programs. Moreover, López-Iñesta et al. [14] discussed a shortage of STEM talent in areas with a broad range of job positions and fair working conditions. Simultaneously, technology forecasting predicts that big data, artificial intelligence, and advanced communications systems drive us towards a Digital Society with a profound transformation of the job market. Thus, women's participation in future communities is mandatory.

Benavent et al. [15] conducted a project in Spain to link student participation in STEM education and Sustainable Development Goals (SDGs). This project was focused on breaking the stereotypes in STEM fields and maintaining women's role models for female students in STEM disciplines, which helps educate children as future citizens and enables a more sustainable future in equity, inclusion, diversity, prosperity, and justice. The project also focused on SDG4 and SDG5 through outreach activities where students, families, teachers, and STEM professional women were involved. They found that, out-of-school time spent on STEM activities and informal learning environments (campuses, camps, etc.) have been shown to be important factors that [16–19] increase, up to 1–8 times, the chances of a student to enrolling in a STEM degree. However, other research indicates that, despite the numerous initiatives and efforts, outreach activities have a much smaller impact on girls, especially in the field of engineering [20].

There is also a significant imbalance in the distribution between the two genders in Africa, as it happens in other parts of the world. Women engineers are few and unable to fully participate in national development. Masanja [21] indicates that, in sub-Saharan African countries, education statistics show that less women continue their education in general compared to men and specifically in science, mathematics, and technology. He investigated examination results and the selection of students to tertiary level institutions from 10 countries. He found that fifty males had the chance to go to a public university for every one hundred who passed the secondary school examination. In contrast, for every one hundred females who passed the test and were eligible, only seven got a chance.

The UN also shows that in sub-Saharan Africa, girls of primary education continue to significantly lag behind boys in mathematical achievement. The same has happened in South-East Asia [22].

According to Rathgeber [23], in Africa, women are not interested in studying sciences and engineering, resulting in low participation in academic positions in science-related subjects. Oanda and Akudol [24] further claim that there are fewer female sub-Saharan African students enrolled in STEM subjects and that their completion rates are lower than those of male students. There is a similar situation in Asian countries. One study, conducted in Pakistan by Malik and Courtney [25], shows that there are few women in higher education participation, as parents prefer to send their son and spend money on him, rather than doing the same for their daughters. Their finding shows that 80% of respondents believe that parents do not spend similar amounts of money on educating their daughters as they do on their sons.

According to UNESCO, women account for fewer than 30% of the world's researchers, and female representation in engineering and computer science is much lower, which is around 10%. A study from 14 countries also found that the probability for a female student graduating with an undergraduate degree in a science-related field is 18%, compared to 37% for male students [26].

The finding of Melak and Singh [27] confirms this low participation of women in engineering and technology education in Ethiopia. According to their conclusion, in the regular undergraduate degree program, the average number of women enrollment in public universities during 2007 to 2016 was 23.34%. In the same year, 13.4% women were enrolled in a postgraduate degree program. Moreover, the average number of women graduates from the total graduate cohort was only 14.5% during the same year. Therefore, increasing the participation of women students is one of the present policy objectives of higher institutions in a country [28].

1.2. Why Do We Need to Study Women's Participation in STEM Education?

There is a need to increase women in engineering and technology fields to find solutions for problems. Women professionals in engineering and technology are necessary to solve climatic change, accessibility of water supply, disease control, etc. Moreover, lower-performing men are frequently selected when women are not well represented in these fields [29]. According to Nishii, creating a heterogeneous labor force in terms of race, ethnicity, gender, religion, etc., is widely linked to enhancing productivity [30]. The women professionals in engineering and technology have an opportunity to engage in high-quality jobs in the field, leading to earning a better salary than other areas [31].

According to UNICEF [11], STEM education improves women's awareness and capacity to participate in actions that protect the environment, position them as leaders in their communities, and actively engaged in a more sustainable society. Women who develop STEM skills are better prepared to contribute to scientific research and technological development initiatives leading to innovative solutions in the industrial sector. STEM knowledge can equip women with the tools to transition from education to employment so that young women improve their livelihoods and contribute to poverty reduction and economic growth. Access to STEM education contributes to women's opportunities to develop transferable, technical, and vocational skills for employment, decent jobs, and entrepreneurship has the potential to accelerate the elimination of gender disparities in access to digital technologies and digital learning. Such activities lead to women as capable players in promoting sustainable development and gender equality in all areas of life. Thus, STEM knowledge and skills can empower women to decide about their maternal health and their children. The STEM fields offer people job opportunities and offer a higher return on educational investment [32]. Yet women remain less well represented in engineering than in any other STEM field [33]. Therefore, studying women's participation in STEM education is an important issue.

Since Ethiopia is among low income and developing countries globally, there is a need for more women in STEM to lift innovation in one step in poverty reduction, social, economic, and environmental development. Hence, conducting more valuable research in the field and preparing policy implications for the concerned stakeholders is an important issue to increase women's number and quality in engineering and technology. Regarding this issue, UNESCO [26] stated that the lack of women in the technology sectors has significant socio-economic consequences, with women losing a vital tool for personal and economic empowerment. According to United Nations Women's Deputy Executive Director Lakshmi Puri, estimates have shown in energy and agriculture, 2.5 million engineers and technicians will be needed in sub-Saharan Africa to achieve improved access to clean water and sanitation [26]. These reasons push to do more research on the participation of women in STEM.

1.3. Factors Affecting Academic Performance of Women in STEM Education

1.3.1. Socio-Cultural Factors

Women's enrollment in education is better today than ever before. Still, they do not always have the same opportunities as boys to complete and benefit from an education of their choice. They are significantly under-represented in STEM education and careers due to low academic performance, which is affected by several factors [34]. According to Almukhambetova and Kuzhabekova [35], most women are challenged by various socio-cultural factors, labor markets, and regional differences, contributing to women's under-representation in STEM fields in Kazakhstan. The concept was also verified by Mamo and Hailu [36]. They studied factors affecting female students' academic performance and competency in Ethiopia by collecting data from 135 female students at Dire Dawa University and found socio-cultural factors, students' behavior, and commitment related factors were significant reasons for women students' poor academic performance and competency. Another finding [37] also shows, country-level socio-economy, cultural and political factors, number of women in parliament, gender inequality, overall equality, and religion are examined as a possible factors affecting girl's achievement in Poland's STEM education. Balakrishnan and Low [38] also examined socio-cultural factors on female engineering perspectives on engineering courses and careers. The study was focused on the Japanese female students' perception of learning by looking at their intention to pursue careers in engineering fields. The findings revealed that socio-cultural values of a society and self-efficacy have strong influences on students' motivation to pursue careers in engineering.

Regarding this self-efficacy and social perception, Lin and Tsai [39] examined the source of gender difference in science learning self-efficacy of high school students in Taiwan. Their finding reveals that society's positive attitudes and any other groups are the sources for strengthened students' science learning self-efficacy dimension of higher-order cognitive skill and science communication. These lead to improving science learning confidence and better academic performance of students in STEM education. They also found that there is a significant difference in social perception between genders. Male students had encouraging experiences through other sounds than their female counterparts. On the other hand, the female students experienced more negative feelings such as stress, anger, and fear than the male students, leading to low academic performance.

The study conducted by Lytle and Shin [40] explored the correlation among incremental beliefs, STEM efficacy, and STEM interest with the help of 1201 participants from undergraduate students in the USA. They found that students who have optimistic thoughts lead to greater STEM efficacy, leading to greater interest in STEM education to achieve better academic performance.

Fernández-Cézar et al. [41] also studied stereotypes in science education concerning pre-university students using 404 participants in Spain. They explored whether the students are stereotyped in perceptions of gender, science, scientists, and the school's rurality. The finding shows that 95% of the sample are agreed as women and men should equally be considered in the scientific profession's egalitarian perception. They also reported that more than 10% sample is stereotyped with different perceptions according to sex and rurality factors. They also found no differences between boys and girls in terms of gender perspective regarding sex. However, they observe the influence of the sense of belonging that women agreed less than men on those items that indicate women's inferiority to men in all situations. They also found the perception of stereotype is declined with increasing age and school level of students. At the same time, stereotyped ideas of gender in science are affected by the school's rurality.

1.3.2. High School Education Background and University Infrastructure

Mersha et al. [42] studied factors affecting women students' academic achievement at Bahir Dar University using data collected from 200 male and 400 female students studying in 6 faculty, including engineering. The finding shows that high school academic background is the main factor for their low academic performance. He also finds that personal characteristics and university environment contribute to their low conducting. Mamo and Hailu [36] also examined institutional factors that can affect women's academic performance and competency.

Another study by Muhammed [4] found that university entrance exam score is the primary determinant of students' academic performance. Yigermal [43] also proved a significant relationship between their previous educational background (university entrance exam) and students' academic performance. A recent study by Raquel et al. [44] also confirmed other studies that can obtain students' understanding and motivation by knowing their educational background.

1.3.3. Teaching Methodology Followed by Teachers and Peer Learning Habit of Students

Riegle-Crumb and Moore [45] examined 2000 students who enrolled in challenge-based engineering courses in Texas. The finding reveals that compared to males, females reported lower interest and less confidence in engineering class since the class is not participatory. Van den Hurk et al. [46] also found that STEM teachers tend to favor men more than women.

Patall et al. [47] also studied students' gender difference in motivational experience during science class at high school education from 208 participants in the USA. They found that compared to male students, women high school students may experience less daily encouragement from teachers in engineering courses, which leads to lower academic performance in STEM subjects except for biology and biomedical science.

Hosaka [48] also studied women's experiences in the engineering laboratory in Japan; this qualitative study examines Japanese women undergraduate engineering students' experiences of interacting with departmental peers laboratory setting. Findings show that women generally had a discouragement experience while working with their male peers. They participated less and lost confidence by comparing with men who appeared to be confident and competent. According to Hosaka's finding, women were not interested in learning in groups with their friends, which is a crucial factor for experience and knowledge sharing, leading to low academic performance. Balakrishnan and Low [38] also focused on the Japanese female students learning experience in engineering programs. The findings revealed that female students' intention to pursue a career in engineering was directly related to the learning experiences.

1.3.4. Academic Curriculum and Sexual Harassment

Garcia Villa [49] studied women students in engineering in Mexico. The study found that academic curriculum was a crucial problem of women's academic performance in engineering. When the engineering program's duration is so long that it discourages learning motivation, it leads to low performance. Molla and Cuthbert [50] investigated women's higher education experience in Ethiopia by taking qualitative data from two government universities. The finding shows that sexual violence and bias contrary to women, indicates inequality in the university. The result suggests that this violence and prejudice can affect the psychological and academic performance of women students. The World Economic Forum and UN also identified some reasons women and girls participate in STEM fields at lower rates, such as discouragement experience, lack of role models, negative peer pressure, and sexual violence. Ability is not an issue, as indicated by several studies. Women from under-represented groups face twice over harassment according to their gender and race. Girls are still struggling for necessary access to education and then for acceptance into the workplace in some countries in the developing world [22,51].

1.3.5. Interventions Followed by Institutions for Supporting Women Students

Van den Hurk et al. [46] studied the effectiveness of interventions applied in STEM education and found that some effective interventions prevent the dropout of initially motivated and most intelligent students in STEM areas. Making institutions a conducive environment for learning can lead to better achievement rather than a dropout. In some countries, including Ethiopia, there is an affirmative action policy for girls to support their education achievement [52]. However, there is an argument about this affirmative action provided for females at the university level. For example, Molla and Cuthbert [50] argued that affirmative action policies slightly benefit females at entry point only not in academic achievement.

1.3.6. Annual Income of the Family and Residence Place

Family income situation is an essential factor in determining the academic performance of children. Muhammedhussen [4] found that family economic situation, sleep time, and habit of study are the main determinants of students' academic performance, while the residential place was insignificant. Lin and Lv [53] also found that family income has a significant influence on child education. According to their finding, increasing family income plays a more substantial role in enhancing children's education in China. Tomul and Çelik [54] carried out a study and found that family income affects academic performance. A recent study by Li and Qiu [55] also considered that urban students' academic performance was more affected by their family socioeconomic status than rural students.

On the other hand, Gobena [56] carried out a study by taking data from Education and Behavioral Science students at Haramaya University, Ethiopia. The finding indicates there is no any effect of family income on students' academic performance. There is a controversy about whether family income affects a student's academic performance or not, which needs further investigation from these reviewed studies.

1.3.7. Educational Background of the Family and the Role Model

Learners will need the full support of their families and other stakeholders to maximize their academic performance potential. Buchmann and Diprete [57] find female superior academic performance in college completion remains the largest in families with a low-educated, but currently extends to all family types. Li and Qiu [55] also found that families who have high-quality education backgrounds and understanding educational opportunities leads to better academic performance. Furthermore, parental education support for their children encourages children's learning behaviors and affects academic performance. Tomul and Çelik [54] also conducted a study in Turkey and confirms parent education affects students' academic achievement. Similarly, Gobena [56] obtained a positive and significant relationship between family educational level and students' academic achievement. Carnasciali et al. [58] also found parental educational achievement levels affect students' performance. Choudhury [59] argued that since children mostly follow their family, educated parents (also other educated adults in the household) are more aware of the benefit of education and invest more in providing quality education.

There are also studies regarding role models that have an impact on women's academic performance. Corbett and Hill [33] concluded that women role models reinforce the perceptions and self-concepts of young women's in mathematics and increase the willingness of women to perceive STEM fields as career opportunities. Sjaastad [60] studied and found teachers are models by displaying how STEM might bring forward someone's success by providing a positive experience with the field. Leavey [61] also reported that women in STEM prefer to have women mentors. The finding supports a study conducted by Shin et al. [62] which indicates women were reported as more interested in STEM after reading biographies of successful STEM role models and reading letters of encouragement women role models.

We have reviewed many papers related to factors affecting women's academic performance in engineering and technology in the context of different countries in the world. Therefore, we found that the previous studies did not study a family profession, year of university establishment, and students' accessibility of information about universities before joining. Therefore, we want to research factors affecting women's academic performance in engineering and technology education, including these three factors with primary data collected from Ethiopia. These can add value to the scope of the literature on women in STEM education. There is also a rationale for more women's participation in engineering and technology in Ethiopia's development and poverty reduction.

2. Materials and Methods

2.1. Objective of the Study

The objectives of this study are:

I To analysis the gender gaps in STEM education with the help of enrollment and graduation data collected from UNESCO and Ethiopian Ministry of Education; and

II To investigate whether (a) peer learning habits of students, (b) interventions followed by institutions for supporting women students, (c) accessibility of university infrastructure, (d) sexual harassment, (e) students having prior information about the university, (f) teaching methodology followed by teachers, (g) accessibility of role model, (h) family educational background, (i) duration of the program or curriculum to study engineering and technology, (j) residence place of students, (k) year of establishment of universities, (l) annual income of the family, and (m) existence of engineering and technology professionals in the family are factors affecting academic performance of women in engineering and technology education.

2.2. Hypothesis of the Study

The study has the following hypothesis based on the objective of analyzing factors affecting women's academic performance in engineering and technology education. These are:

1. Women students who have higher scores on the result of the grade 12 exam will present higher academic performance in engineering and technology education at the university level [43,44];
2. Students who provided academic, financial, and psychological support by the university will have better academic performance [46];
3. Students affected by sexual harassment will present lower academic performance [50];
4. Students who are comfortable with teaching methodology followed by their teachers will record high academic performance [45];

5. Students having a habit of learning in groups will present high academic performance [48,63];
6. Better accessibility of university infrastructure will have a positive impact on students' academic performance [36,42];
7. Students who have the accessibility to information about the university before joining will increase the academic performance of students;
8. Students who have family educational background will score good academic performance [55,56,58];
9. Students who studied the same profession as their family will have better academic performance;
10. Students who have the accessibility of role model will present high academic performance [61];
11. The student who came from the urban area of residence place will score higher academic performance [4];
12. Students who have a better annual income of the family will have high-performance [53];
13. Students will be discouraged with a long time duration of education curriculum that declines their performance [49];
14. Students who studied in old-established and most experienced universities will score high performance.

2.3. Study Area

This study has been conducted based on women's primary and secondary data in engineering and technology education from Ethiopia. There are nine states and two city administrations in a country. In Ethiopia, higher education started in the 1950s following the establishment of the first higher education institution, Addis Ababa University. The number of higher education institutions before the 1990s was only 5. Little progress has been observed in expanding higher education institutions until introducing the current education and training policy in 1994 [64]. Presently, around 44 public universities/colleges provide all types of courses after 2000. Mostly, engineering and technology universities, which is 26% of the total, are found in Addis Ababa, followed by Oromia and Amhara.

2.4. Procedure, Data Collection and Sampling

Primary data have been collected through stratified sampling. Firstly, the Amhara region was randomly selected as a sample state, one of among nine states in a country. The state has ten public higher institutions. Secondly, we categorized ten public higher institutions into four-groups based on the establishment year. The first group includes Bahir Dar University and Gondar University, established as a college in 1954 and recognized as a university in 2000. The second group comprises Debre Birhan University, Debre Markos University, and Wollo universities, which were founded in 2005. The third category includes Debre Tabor University and Woldia University, established in 2008. Finally, Injibara University, Mekdela Amba University, and Debark University, established in 2015, are included in the fourth category.

Thirdly, we select three universities from each group except the fourth category. These are Bahir Dar University, Wollo University, and Debre Tabor University. The selection of sample universities from each group has been made purposively. Since universities established at different times can have different experiences, universities' choice within group was random. Data not collected from 4th group universities since they are new and started working in the 2017/2018 academic year, so that they may not have sufficient data for this study. In Ethiopia, higher education costs such as hostel fees, food, etc., are covered by the government via cost-sharing agreements. Most students are placed to go to university according to their grade 12 marks through placement by the education ministry. Students come from all country directions representing different economic statuses, religions, cultures, languages, and so on. Hence, the sample is representative.

Fourthly, we determine the sample size. For this determination of the number of respondents, we follow procedures. Thus, we have got the total population of women students in engineering and technology in the selected universities during 2018 was 3668. From these entire populations, we have determined 376 sample respondents based on equation one [65].

$$n = \frac{Z^2.p.q.N}{e^2(N-1) + Z^2.p.q} \quad (1)$$

It is valid where n is the sample size, $N = 3668$ (population size), Z^2 is standard variate at the desired confidence level of 95.5% $= (2.01)^2$, $e = 45\%(0.045)$ is the desired level of precision (acceptable error), the range in which the actual value of the population is estimated to be. Whereas p is the estimated proportion of an attribute present in the people taken as 30% and q is $(1-p)$.

Fifth, we did proportions according to total women students in each sample university. Hence, 227 (60%) respondents from Bahir Dar University, 96 (26%) respondents from Debre Tabor University, and 53 (14%) respondents from Wollo University, a total of 376 respondents have been selected for the study as given in Table 1. Based on this procedure, primary data have been collected from 376 women students enrolled in engineering and technology faculty through structured questionnaires. These students study from 1st year to 5th year during May 2018.

Table 1. Selected total sample respondents.

	Bahir Dar University	**Debre Tabor University**	**Wollo University**	**Total**
	Engineering and Technology	**Engineering and Technology**	**Engineering and Technology**	
No. of students	2212	935	521	3668
No. of respondents	227	96	53	376
Percentage	60%	26%	14%	100%

2.5. Sample Description

As shown in Table 2, the respondents' cumulative GPA is categorized into three levels since CGPA is standardized from zero to four in the Ethiopian grading system of students' academic results. In this background, 64 respondents have below 2.5 score marks; 139 students have scored 2.5 and above but below 3; most respondents have 3-grade points and more. Students' high school performance is a proxy of grades 12 exam results that 40 respondents obtain below half out of 700 marks from around seven subjects, whereas 336 respondents have got 350 and above. Out of 376 samples, 241 have family educational background while 135 respondents have not such family. Out of the total sample, 183 respondents rate accessibility of adequate university infrastructure (i.e., laboratory, library, hostel etc.) as suitable manner, whereas 48 respondents rate it as below satisfaction. From the total respondents, 234 have got the chance of university support directly and indirectly. Regarding sexual harassment, most of the students, especially women, are affected by this problem in any direction from the staff, their peers, but they do not want to talk due to fear and feeling dishonor. Thus, the sample's response shows only 111 students said, "yes, I am harassed". However, we believe that the actual figure will be more than this number (see Table 2).

Table 2. Summary of demographic and socio-economic status of respondents.

Demographic and Socio-Economic Variables	Responses	
Cumulative GPA	<2.5 ≥2.5 and <3 ≥3	64 139 173
High school education performance	<350 = 40	≥ 350 = 336
Family educational background	No = 135	Yes = 241
Pre-informed about the university they have joined	No = 124	Yes = 254
Accessibility of university infrastructure	low = 48 good= 183	medium = 145
Interventions followed by institutions for supporting women students	No = 142	Yes = 234
Sexual harassment	No = 265	Yes = 111
Having engineering and technology professionals in the family	No = 189	Yes = 187
Number of family members	Less than five = 85 Between 5 and 10 = 283	More than 10 = 8
Income of the family	< 50,000 = 184	≥ 50,000 = 192
Place of residence	Rural = 133	Urban = 243
Access of role model	No = 143	Yes = 233
Effect of duration of the program	No = 227	Yes = 149
Teaching methodology	Partly = 119	Yes = 257
Peer learning	No = 118	Yes = 258

2.6. Definition of Variables and Instruments

Academic performance has been measured by cumulative marks of women obtained from the faculty of engineering and technology in the duration of a five year study period. Cumulative marks in higher education are ranging from zero to four scale awards A = 4, B = 3, C = 2, D = 1, and F for 0 with a "plus" or "minus" grade awarded. A and A^+ have the same grade point, and 2 points average score is a minimum graduation criterion. Hence, academic achievement is measured by the student's average score mark. Witherspoon and Christian [66] also examine gender difference in educational attainment by taking this GPA as a measure of academic performance.

Students peer learning habits are also measured as 1 = "yes, I have an experience of learning with other students outside the classroom," and 0 = if not. Riegle-Crumb and Moore [45] measured this variable through five Likert scales from strongly disagree to strongly agree through the questionnaire. Such as "would you relate yourself with the people around you in this class," and "could you think that most of the skills learned from outside the class would be useful to you in engineering?" Based on these previous studies, this study also incorporated peer learning habits of the student, which will impact the academic performance of women students.

Interventions followed by institutions for supporting women students were also measured by yes = one if students obtain university support and 0 = if not. Van den Hurk et al. [46] measured this variable through investigating research literature that "What kind of interventions are should take in raising interest and sense of belonging in STEM education among women and men?" Accessibility of university infrastructure is also valued in three levels; low, medium, and good, using the questionnaire "How do you rate infrastructural accessibility and services provided in your university?" [67]. Sexual harassment is another variable considered dichotomous and measured by asking whether students have an experience of any sexual harassment or not [22,51].

Students having prior information about the university is also considered and measured using a questionnaire "Do you have gathered general information about the institution which you have joined before entering?" Similarly, the existence of engineering and technology professionals in the family has measured using the questionnaire, "Do you have a person in your family who graduated in engineering and technology filed of study?"

Riegle-Crumb and Moore [45] measured teachers' teaching methodology via a Likert scale with the question of "Do you think that your instructors are encouraging you in engineering class?" Patall et al. [47] also measured teacher's encouragement of students in daily class by five items with five Likert scales. It is also estimated as one = "yes I am comfortable with teaching methodology followed by the teacher," and 0 = "I am partly comfortable".

High school education performance is measured through the final semester of the grade 12 Entrance Examination, provided for countrywide Ethiopian University in seven natural science subjects. Exam performance is graded as zero to hundred point scale with a total possible scoring of 700 in seven subjects. Minimum scores for university admission decided by the Ministry of Education of Ethiopia. Therefore, high school educational performance is a continuous variable measured by the grade 12 exam [4,44].

Family educational background is measured as 1 = yes, there is an educated person in the respondent's family, and 0 = if not. Riegle-Crumb and Moore [45] measured family education background by four groups: secondary school level, special occupational training, college level, or advanced degree. In this study, family education background has been taken as a dummy variable whether all family members are illiterate or educated.

Access to role model is also a variable valued as 1 = yes; 0 = I have no role model [33]. The previous studies [4] measured the residence place by kilometer from students home to universities. However, in this study, residence place is categorized into two. Students who belong to rural areas are denoted by 0, and 1 represents students from urban areas. The family's annual income is another continuous variable measured in thousands of Ethiopian Birr [4].

Duration of the program or curriculum to study engineering and technology has been measured through the questionnaire "Have you feeling tired with staying five-year study to complete your degree in engineering and technology?" [49]. This study also considers the establishment of universities as a factor affecting the academic performance of students. It is measured whether students are studying in first group universities or not since senior educational institutions are more experienced and will have a better learning environment.

2.7. Data Analysis

Women students' academic performance in engineering and technology education is a dependent variable affected by independent factors. These are peer learning habits of students, interventions followed by institutions for supporting women students, accessibility of university infrastructure, sexual harassment, students having prior information about the university, existence of engineering and technology professionals in the family, role model, the annual income of the family, high school education performance of students, duration of the program(curriculum), family educational background, and year of establishment of universities.

Checking the reliability of data is an essential issue during primary data analysis. One of the most used reliability estimators is Cronbach's Alpha [68]. This reliability test has computed that shows data are reliable with a scale reliability coefficient of 0.7. The correlation of each independent factor with women students' academic performance in engineering and technology has also computed using Spearman's rank correlation coefficient as given in Table 3. From this table, the correlation coefficient of family income ($p = 0.6$), duration of the program ($p = 0.07$), teaching methodology ($p = 0.3$), high school educational performance (0.2), and year of establishment of universities ($p = 0.29$) are more than standard significant level $p \leq 0.05$ and being insignificant.

Ordinary Least Squire Multiple Linear Regression Analysis also conducted to analyze the most important factors affecting women's academic performance in engineering and technology, which are the reason for the gender imbalance in STEM education. Diagnostic tests, such as multicollinearity, heteroscedasticity, and link test of the model specification, were computed. Moreover, a normality test of residuals is conducted to check the estimated coefficients and model fitting unbiasedness. Secondary data have also been analyzed through descriptive methods. All analyses were carried out with the STATA 14 software.

Table 3. Spearman's rank correlation coefficient test and statistical summary of variables.

Variables	Correlation Coefficient	Sg.Level	Mean	Std. Dev.
Family educational background (FEDUC)	0.1254	0.0150	0.6409574	0.4803589
Existence of engineering and technology professionals in the family (FP)	0.2267	0.0000	0.4973404	0.5006591
Role Mode (RM)	0.2096	0.0000	0.6196809	0.4861121
Residence Place (RP)	−0.1281	0.0129	0.6462766	0.4787617
Family Income (INC)	0.0231	0.6558	73357.98	105802.1
Duration of the program (DP)	0.0926	0.0728	0.3962766	0.4897749
Teaching methodology (TM)	0.0527	0.3084	0.6835106	0.465726
Peer Learning (PL)	0.4253	0.0000	0.6861702	0.4646664
Accessibility of university infrastructure (AUIF)	0.6045	0.0000	1.359043	0.6976709
Sexual harassment (SH)	−0.5487	0.0000	0.2952128	0.4567461
Interventions followed by institutions for supporting women students (Usport)	0.5628	0.0000	0.6223404	0.4854478
Pre informed about the institution before joining (PI)	0.6942	0.0000	0.6702128	0.4707622
High school education performance (HEP)	0.0628	0.2243	391.9707	42.80644
Year of establishment of universities (YE)	−0.0542	0.2948	0.6037234	0.4897749

Sg.level = significant level (*p*-value), Std. Dev. = standard deviation.

2.8. Model Specification

The factors affecting academic performance were analyzed through Multiple Linear Regression Analysis, which allows many elements in the model. According to Wooldridge [69], the variable's linear function is specified in equation two, and regression estimation has been conducted based on this equation.

$$\begin{aligned} CGPA = \beta_0 + \beta_1 Usport + \beta_2 SH + \beta_3 PL + \beta_4 AUIF + \beta_5 PI \\ + \beta_6 FEDUC + \beta_7 FP + \beta_8 RM + \beta_9 RP + \epsilon_i \end{aligned} \tag{2}$$

where $CGPA$ = cumulative marks, $Usport$ = interventions followed by institutions for supporting women students, SH = sexual harassment, PL = peer learning, $AUIF$ = accessibility of university infrastructure, PI = students prior information about the university they have joined, $FEDUC$ = is family educational background, FP = existence of engineering and technology professionals in the family, RM = role model, RP = residence place of students, β_0 is the intercept(constant term), $\beta_1, \ldots, \beta_9$ are parameters associated with variables, and ϵ_i a disturbance term which is not observable but it can affect a dependent variable.

3. Results

3.1. Descriptive Results

As already mentioned in the second section, the first objective of this study is to explain the gender gaps in STEM education. Based on available data from the Ethioia's Ministry of Education [70], and UNESCO [71], the participation of men and women in STEM was portrayed using graphical diagrams.

Figure 1 shows the percentage share of women's and men's enrollment in engineering and technology progress in the last decades. However, there is a wide gender gap. To solve this under-representation of women, the Ethiopian Ministry of Education adopts a new policy whereby 70% of overall university enrollment registers in a science field, and the remaining 30% in the social sciences and business economics. This policy was built on the bases of the goal of Ethiopia to generate more graduates in science, technology, engineering, and mathematics and to increase the number of women in the field, helping to secure the countries sustainable development [27].

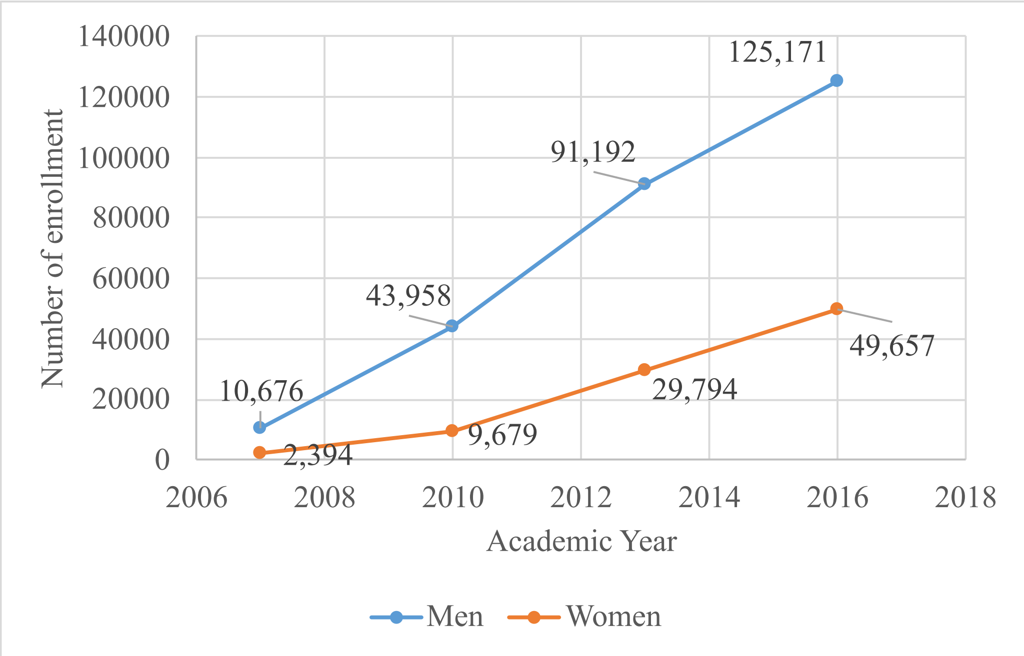

Figure 1. Students enrolled in engineering and technology education in Ethiopia.

Students enrollment in STEM education such as in mathematics, chemistry, physics, biology, and statistics in Ethiopia has given in Figure 2. Again this figure shows a gender imbalance though the gap is narrowing recently [27].

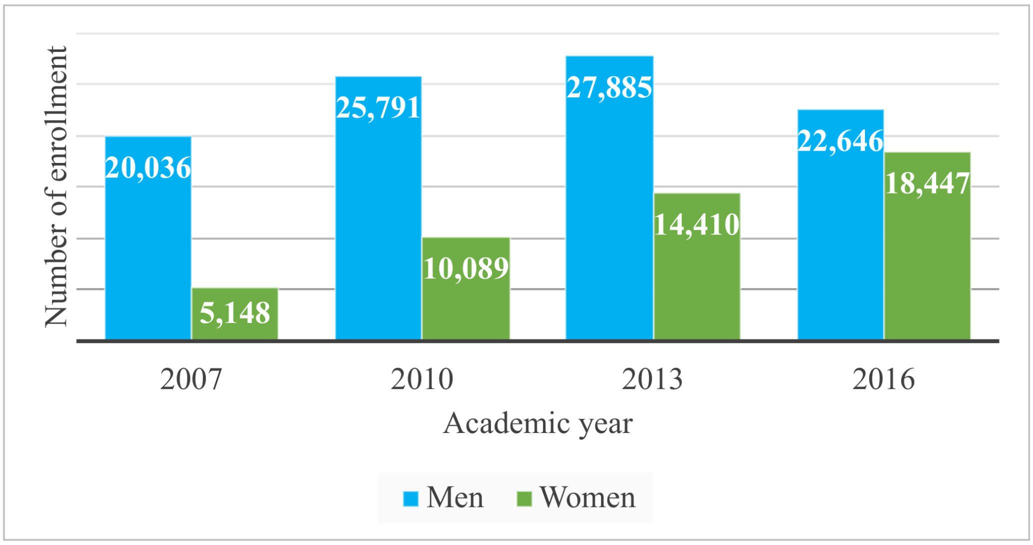

Figure 2. Students enrollment in STEM education excluding engineering and technology in Ethiopia.

Figure 3 shows the number of graduated students in engineering and technology education in Ethiopia from 1999 to presently. Again, there is a huge imbalance, and the gap is increasing over time due to dropout. Since most female students are dismissed and drop out from universities after learning some times due to low academic performance and related issues leads to a wide gender gap in STEM fields [27].

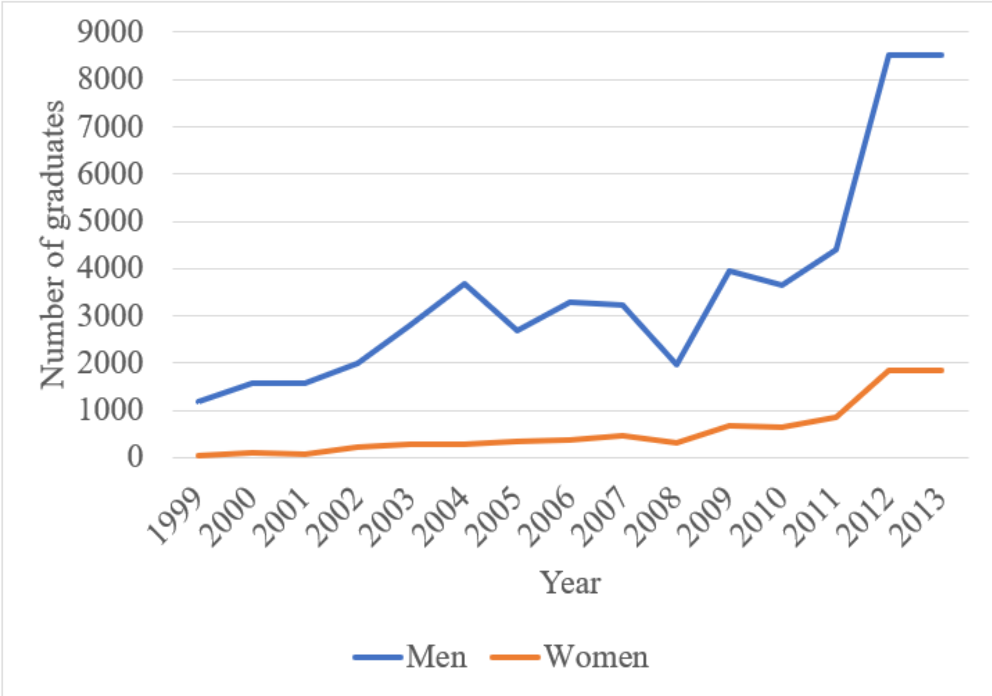

Figure 3. Students graduated in engineering and technology education in Ethiopia.

The participation of women in STEM education for three consecutive years in Africa has also been given in Figure 4, which indicates most countries have below 20% share of women who graduated in STEM education. However, Mauritania and Algeria have done better than others [7,72].

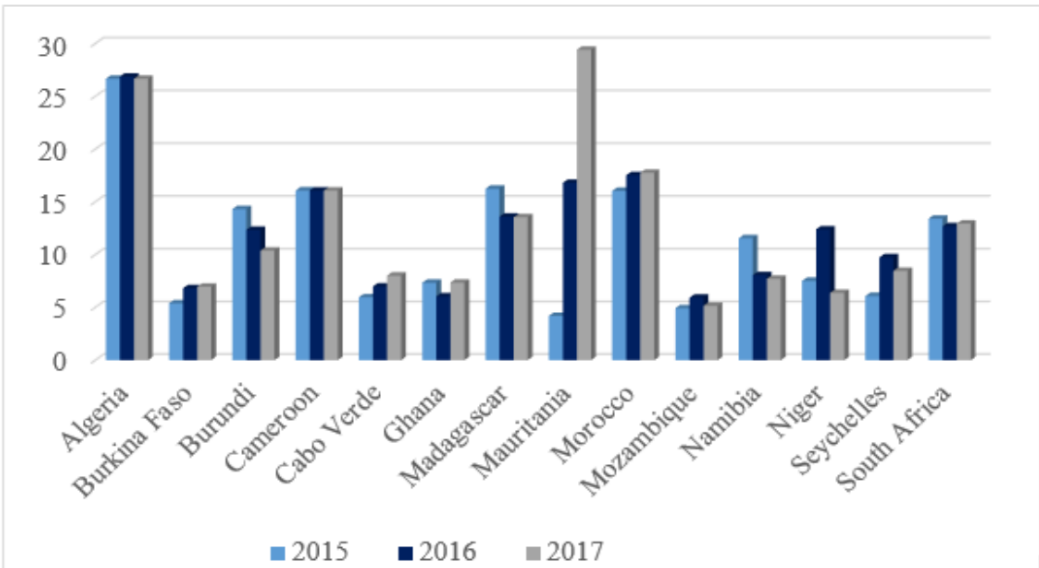

Figure 4. Percentage of women graduates in STEM education in Africa.

Women enrollment in engineering, manufacturing, and construction fields is below 14% in various countries, as shown in Figure 5. From this Figure, Romania, Tunisia, and Portugal have better performance during 2016 and 2017, whereas statistics for Burundi, Burkinafaso, the USA, and the UK show a low proportion. Cebr Analysis of Royal Academy also conducted a study using cross-sectional data from 90 countries that offer the gender gap in STEM education in most parts of the world, supporting the current study [7,72].

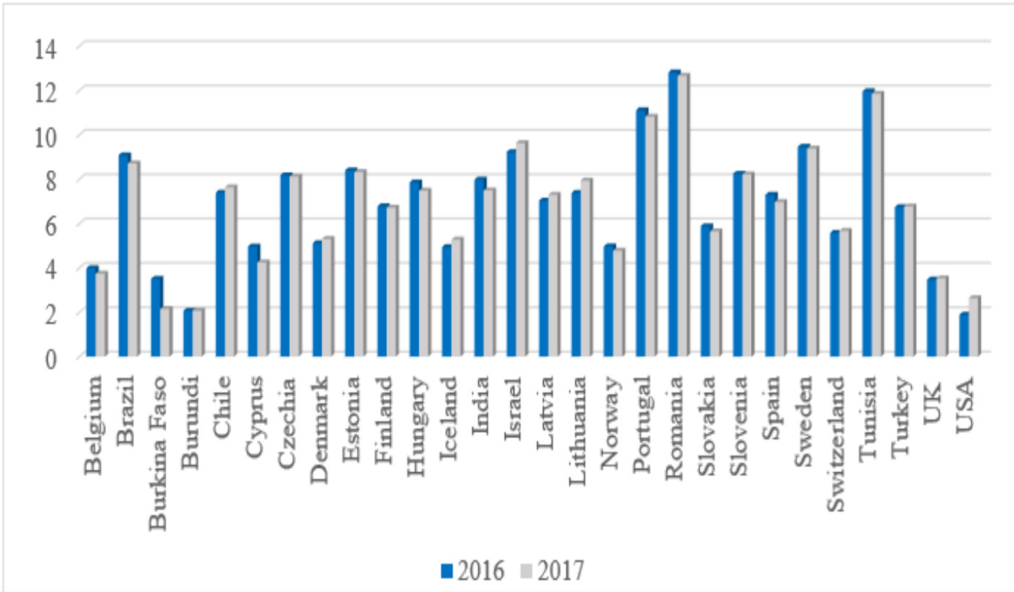

Figure 5. Status of women enrollment in engineering, manufacturing and construction field.

Similarly, Figure 6 shows the percentage of women graduates in science, technology, engineering, and mathematics areas of study in three consequent academic years worldwide. We can see that Oman and India [7,72,73] have better performance. In general, these given Figures indicate the existence of low representation of women in STEM education worldwide [74].

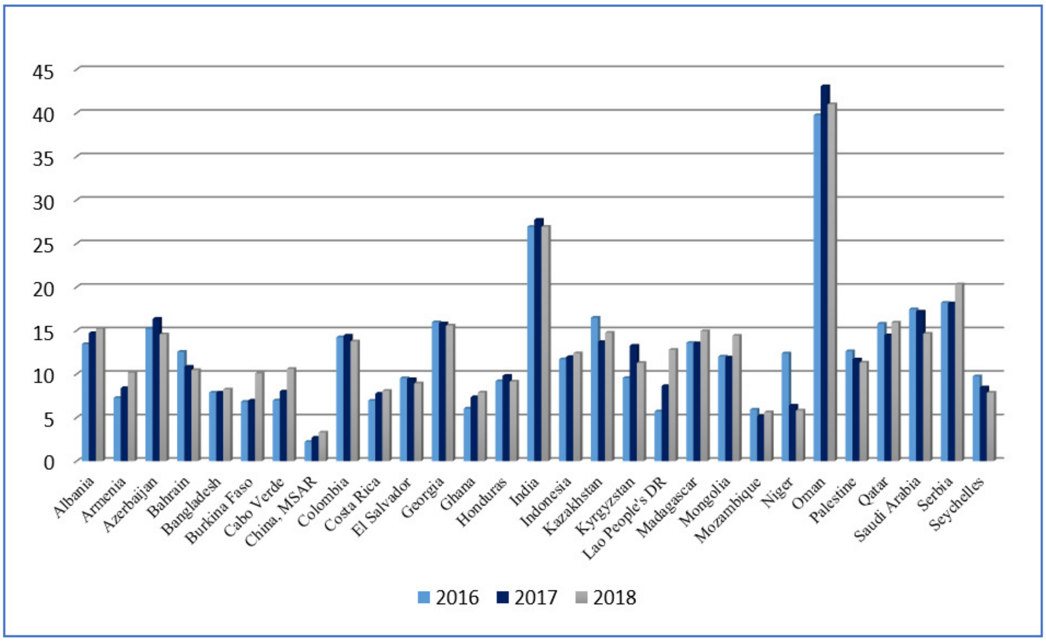

Figure 6. Percentage of women graduates in STEM education in various world countries.

3.2. OLS Regression Analysis

OLS linear regression was used to identify the factors that affect women's academic performance, which is the primary reason for the under-representation of women in STEM education. As explained in the second section of the paper, the dependent variable is women's academic performance, measured by the cumulative grade point. After checking Spearman's rank correlation test, nine independent variables were included in the model, and various diagnostic tests were conducted. The value of R^2 64.9% shows the model fit. The Shapiro-Wilk normality test of residuals is also one of the tests which confirm residuals are normally distributed with a *p*-value of 0.61283. Furthermore, supported by the link test, a *p*-value of residual square 0.226 leads to accepting the null hypothesis stated that the model is well specified.

A multicollinearity problem among independent variables is also conducted by the Variance Inflation Factor test, where a Mean VIF of 1.72 shows no such problem among the explanatory variables. The Robust test has also checked the assumption of constant variance in the model to avoid heteroscedasticity if any.

Scatter diagram and histogram were also made in the residual of variable and found that the error has a normal distribution, which is mean zero, homoscedasticity, and independent of each other. Presented in Figure A1a,b, which shows the residual's variation stays much the same across the data, apart from the one outlier. Hence, the residual variance can be treated as constant, and the mean of residuals is approximately zero as presented in the histogram.

Corresponding to all of these diagnostic tests of regression coefficients, students having prior information about the institution is an important variable that has a significant and positive impact at 1% level. A unit increase in students gathering preliminary information about the university leads to 0.375 unit increases in their academic performance than others on average, as given in Table 4.

The interventions of universities in supporting women positively and significantly affects women students' academic performance in engineering and technology education at 1% level. A one-unit increase in university support yields 0.187 unit improvement in women's academic performance.

Peer learning is also an essential variable with a positive and significant influence at 1% level. A unit increase in this variables leads to a 0.132 unit that increases averagely on women students' academic performance in engineering and technology education.

Similarly, accessibility of university infrastructure has a positive and significant impact at 1% level that on average, 1 unit increase in the supply of these infrastructure related to 0.168- and 0.39-unit improvement, respectively when the supply is medium and a good standard on academic performance of women students in engineering and technology education.

The existence of engineering and technology professionals in the family or family profession has a negative and significant impact at 10%. On average, a unit increase in the existence of engineering and technology family professionals leads to a 0.063-unit decline in women students academic performance. Sexual harassment also has a significant and negative impact at 1% level that, on average, a unit increase in sexual harassment leads to a 0.136-unit decline in women students' academic performance.

Table 4. Significant variables in the OLS regression model

CGPA (Academic Performance)	Coef.	Robust SE	*t*-Value	*p*-Value	95% Conf. Interval	
					Lower	Upper
Interventions followed by institutions for supporting women students	0.1878082	0.0365764	5.13	0.000	0.1158813	0.259735
Sexual harassment	−0.1365386	0.0386175	−3.54	0.000	−0.2124793	−0.060598
Peer learning habit of students	0.1318955	0.0361807	3.65	0.000	0.0607467	0.2030442
Accessibility of university infrastructure						
Medium	0.1685265	0.0490086	3.44	0.001	0.0721519	0.2649012
Good	0.3924886	0.0547922	7.16	0.000	0.2847406	0.5002367
Students having prior information about the university	0.3752453	0.0406874	9.22	0.000	0.2952342	0.4552564
Family profession	−0.0630425	0.0342077	−1.84	0.066	−0.1303114	0.0042263
cons	2.233827	0.0608458	36.71	0.000	2.114175	2.35348

coef. = coefficents, Robust SE = robust standard error, *p*-value = significance level.

4. Discussion

The developing economy needs academically qualified STEM professionals, including women, to contribute crucial sustainable development roles and achieve the 2030 Agenda of SDGs. These can be considered to promote women's empowerment, mainstream gender equality, and achieve peaceful societies with full human potential [1,2,5,15]. In this background, the paper under discussion analyzes women's enrollment and graduation in STEM education. The statistical analysis of secondary data shows women under-represented in STEM education in Ethiopia and the world, even though some countries have better trends.

This study also attempted to identify factors associated with women students' academic performance in engineering and technology with all diagnostic tests. The result indicates that students having prior information about the institution is the most significant variable that positively impacts academic performance. When the students have previous general information about the institution before joining, they will have psychological readiness, which improves academic performance. The prior knowledge can be about courses, curriculum, administration, examination system, etc., which are performing in the universities. Thus, a variable was not studied by existing studies in the literature as factors that affect students' academic performance. Hence, this factor's finding, which positively influences educational performance, will add value to the existing literature.

Additionally, the result confirms the hypothesis of the positive relationship between the accessibility of university infrastructure (i.e., library, laboratory, dormitory, internet access, water sanitation, food supply, security, etc). Furthermore, women students' academic performance in engineering and technology education, as supported by the previous studies, found that the university environment contributes to students' academic performance [36,42].

The result also confirms that interventions followed by institutions for supporting women students like the (academic, financial, and psychological treatment) given to girls by the university community are another significant variable that can improve women's academic performance. The previous study also finds and confirms the effectiveness of interventions applied in STEM education associated with academic successes [46]. Robsan Margo [52] argued that students capability to complete their studies is related to the sustainable supports of universities.

Students' learning habits are a significant variable that affects women students' academic performance in engineering and technology. It is consistent with the finding of Chachashvili-Bolotin et al. [63] states that the STEM learning experience positively associates with students' interest in pursuing and achieving STEM fields in tertiary education.

A finding by Hosaka [48] also confirmed as there is a link between students' learning experience and academic performance. He found that women were not interested in learning in groups with their friends (which is an essential factor for experience and knowledge sharing), leading to low academic performance.

The hypothesis of the negative impact of sexual harassment on women's academic performance has been confirmed in this study. Several existing studies confirm these results. Molla and Cuthbert [50] found women experience of sexual violence and bias affects women students' psychological and academic performance. The World Economic Forum and UN also identified negative peer pressure and harassment as reasons women's academic performance remains low-level [22,51].

Furthermore, result of this study indicates that the existence of engineering and technology professionals in the family has a negative and significant impact on women's academic performance in engineering and technology education. Which may happen: if the family members who graduated in this profession may not have a job due to a shortage of employment opportunity, STEM professionals in the family may provide exaggerated pessimistic information about STEM education that will create tension in the students mined, the student may observe lack of freedom from their STEM professional families due to the challenging nature of STEM courses that need more effort for success, if students observe discouraging experience of their family who holds STEM profession by government or others bodies on the bases of political perception, race, religion, gender, etc., and if professionals in STEM have an unsuccessful life. As far as our knowledge, this variable did not study by existing research. The previous studies in the literature mostly take the family's academic background, which affects academic successes but not considering the existence of engineering and technology professionals in the family specifically.

The previous studies [4,42–44,63] found that high school educational background impacts students' future academic performance. However, the Spearman's rank correlation test shows that high school education performance is insignificant. It may happen due to maladministration of grade 12 examination that is highly exposed to cheating, which leads to high score recording without their skill and knowledge. Additionally, there may be limited access to employment opportunities and a highly corrupted government system during recruitment, leading students to be hopeless and careless in their academic performance.

Having such results, the finding of this study concludes: students having prior information about the university before joining, better accessibility of university infrastructure, interventions followed by institutions for supporting women students, peer learning habit of students, sexual harassment, and the existence of engineering and technology professional in the family are an essential factor which affects the academic performance of women according to ranking the strength of the impacts of the variable based on the value of t-statistics in the regression result given in Table 4.

The finding implies that women students themselves, educational organizations, government, and other stakeholders should enhance women's academic performance, reducing gender gaps in STEM education and promoting sustainable development [2,5,15]. Students must have peer learning experience, and should have information about the universities (system, rules, regulations, etc). Engineering colleges must pay attention to students' psychological, economic, and academic support, try to arrange infrastructure and learning facilities, and protect students through strong commitment and regulations from sexual harassment. The government must enhance education quality by paying more attention to the examination system, recruiting professionals according to their ability rather than through corruption, race, gender, religion, etc. that leads to discouraging students' academic achievement.

There is a limitation of the present study that leads us to propose future works. In the first place, this research has been carried out by considering only students studied in government universities. Therefore, it would be necessary to extend these studies by including private institutions also.

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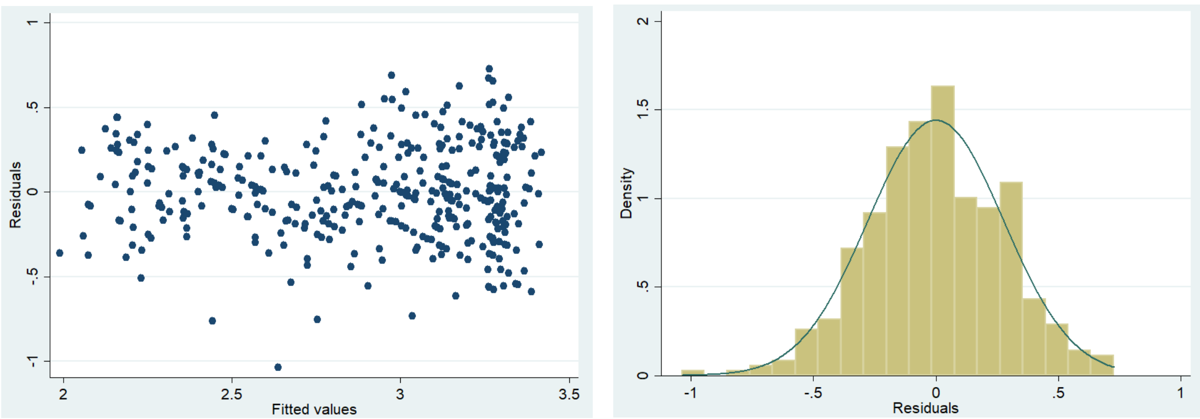
Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Appendix A.1



(**a**) (**b**)

Figure A1. Normality test of residual presenting (**a**) scatter plot and (**b**) histogram with normal distribution.

References

1. United Nations. 17 Goals to Transform Our World 2020. Available online: https://www.un.org/sustainabledevelopment/inequality/ (accessed on 26 January 2021).
2. Di Fabio, A. The psychology of sustainability and sustainable development for well-being in organizations. *Front. Psychol.* **2017**, *8*, 1534. [CrossRef]
3. Gebreluel, G. Ethiopia's Grand Renaissance Dam: Ending Africa's oldest geopolitical rivalry? *Wash. Q.* **2014**, *37*, 25–37. [CrossRef]
4. Muhammedhussen, M. Determinants of economics students' academic performance: Case study of Jimma University, Ethiopia. *Int. J. Sci. Res. Publ.* **2016**, *6*, 566–571.
5. Robert, K.W.; Parris, T.M.; Leiserowitz, A.A. What is sustainable development? Goals, indicators, values, and practice. *Environ. Sci. Policy Sustain. Dev.* **2005**, *47*, 8–21. [CrossRef]
6. Zorzano, M.P. Gender Balance in Mars Exploration: Lessons Learned from the Mars Science Laboratory. *Sustainability* **2020**, *12*, 10658. [CrossRef]
7. Singh, S.; Peers, S.M.C. Where are the Women in the Engineering Labour Market? A Cross-Sectional Study. *Int. J. Gender, Sci. Technol.* **2019**, *11*, 203–231.
8. Mahajan, P. Engineering a Woman: Marketing Opportunities and Challenges. *Turk. Online J. Educ. Technol.* **2017**, *2*, 11–22. [CrossRef]
9. Wang, M.T.; Degol, J.L. Gender gap in science, technology, engineering, and mathematics (STEM): Current knowledge, implications for practice, policy, and future directions. *Educ. Psychol. Rev.* **2017**, *29*, 119–140. [CrossRef]
10. Sikora, J.; Pokropek, A. Gender segregation of adolescent science career plans in 50 countries. *Sci. Educ.* **2012**, *96*, 234–264. [CrossRef]
11. UNICEF. ITU, Towards an Equal Future: Reimagining Girls' Education through STEM. 2020. Available online: https://www.unicef.org/media/84046/file/Reimagining-girls-education-through-stem-2020.pdf (accessed on 17 December 2020).
12. Botella, C.; Rueda, S.; López-Iñesta, E.; Marzal, P. Gender diversity in STEM disciplines: A multiple factor problem. *Entropy* **2019**, *21*, 30. [CrossRef] [PubMed]
13. Rodríguez-Rivero, R.; Yáñez, S.; Fernández-Aller, C.; Carrasco-Gallego, R. Is It Time for a Revolution in Work–Life Balance? Reflections from Spain. *Sustainability* **2020**, *12*, 9563. [CrossRef]

14. López-Iñesta, E.; Botella, C.; Rueda, S.; Forte, A.; Marzal, P. Towards breaking the gender gap in Science, Technology, Engineering and Mathematics. *IEEE Rev. Iberoam. Tecnol. Del Aprendiz.* **2020**, *15*, 233–241.
15. Benavent, X.; de Ves, E.; Forte, A.; Botella-Mascarell, C.; López-Iñesta, E.; Rueda, S.; Marzal, P. Girls4STEM: Gender diversity in STEM for a sustainable future. *Sustainability* **2020**, *12*, 6051. [CrossRef]
16. Kitchen, J.A.; Sonnert, G.; Sadler, P.M. The impact of college-and university-run high school summer programs on students' end of high school STEM career aspirations. *Sci. Educ.* **2018**, *102*, 529–547. [CrossRef]
17. Mohr-Schroeder, M.J.; Jackson, C.; Miller, M.; Walcott, B.; Little, D.L.; Speler, L.; Schroeder, D.C. Developing Middle School Students' Interests in STEM via Summer Learning Experiences: See Blue STEM Camp. *Sch. Sci. Math.* **2014**, *114*, 291–301. [CrossRef]
18. Roberts, T.; Jackson, C.; Mohr-Schroeder, M.J.; Bush, S.B.; Maiorca, C.; Cavalcanti, M.; Cremeans, C. Students' perceptions of STEM learning after participating in a summer informal learning experience. *Int. J. Stem Educ.* **2018**, *5*, 1–14. [CrossRef] [PubMed]
19. Demetry, C.; Sontgerath, S. A middle school engineering outreach program for girls yields STEM undergraduates. In Proceedings of the American Society of Engineering Education Annual Conference & Exposition ASEE, Columbus, OH, USA, 25–28 June 2017.
20. Legewie, J.; DiPrete, T.A. The high school environment and the gender gap in science and engineering. *Sociol. Educ.* **2014**, *87*, 259–280. [CrossRef]
21. Masanja, V.G. Increasing women's participation in science, mathematics and technology education and employment in Africa. In *United Nations Division for the Advancement of Women: Expert Group Meeting: Gender, Science, and Technology*; National University of Rwanda and University of Dares Salaam: Butare, Rwanda, 2010.
22. United Nation. The World for Women and Girls Annual Report 2020. Available online: https://www.unwomen.org/en/digital-library/publications/2020/06/annual-report-2019-2020 (accessed on 17 December 2020).
23. Rathgeber, E.M. Women in Universities and University-Educated Women: The Current Situation in Africa. In *African Higher Education: An International Reference Handbook*; Indiana University Press: Bloomington, Indiana, 2003.
24. Oanda, I.; Akudolu, L. Addressing Gender inequality in higher education through targeted institutional responses: Field evidence from Kenya and Nigeria. In *Higher Education in Africa: Equity, Access Opportunity*; Institute Of International Education (IIE): New York, NY, USA, 2010; p. 23.
25. Malik, S.; Courtney, K. Higher education and women's empowerment in Pakistan. *Gend. Educ.* **2011**, *23*, 29–45. [CrossRef]
26. UNESCO. UNESCO's role in encouraging girls and women to be leaders in science, technology, engineering, art/design, and math fields. In Proceedings of the Conference: UNESCO Executive Board of 199th, Paris, France, 6 April 2016.
27. Melak, A.; Singh, S. The status of women participation in engineering and technology profession and their challenges in working institutions. *Int. J. Manag.* **2020**, *11*, 122.
28. Federal Ministry of Education. *Education Sector Development Programme V (ESDP V) 2008–2012 E.C. 2015/16–2019/20 G.C*; Federal Ministry of Education: Addis Ababa, Ethiopia, 2015. Avilable online: https://www.unicef.org/ethiopia/media/1396/file/Education%20Sector%20Development%20Programme%20V%20(ESDP%20V).pdf (accessed on 04 December 2020).
29. Reuben, E.; Sapienza, P.; Zingales, L. How stereotypes impair women's careers in science. *Proc. Natl. Acad. Sci. USA* **2014**, *111*, 4403–4408. [CrossRef] [PubMed]
30. Nishii, L.H. The benefits of climate for inclusion for gender-diverse groups. *Acad. Manag. J.* **2013**, *56*, 1754–1774. [CrossRef]
31. Carnevale, A.P.; Smith, N.; Melton, M. *STEM: Science Technology Engineering Mathematics*; Georgetown University Center on Education and the Workforce: Washington, DC, USA, 2011.
32. Landivar, L.C. Disparities in STEM employment by sex, race, and Hispanic origin. *Educ. Rev.* **2013**, *29*, 911–922.
33. Corbett, C.; Hill, C. *Solving the Equation: The Variables for Women's Success in Engineering and Computing*; American Association of University Women: Washington, DC, USA, 2015.
34. UNESCO. Girls' and Women's Education in Science, Technology, Engineering and Mathematics (STEM). 2019. Available online: https://en.unesco.org/stemed (accessed on 17 December 2020).
35. Almukhambetova, A.; Kuzhabekova, A. Factors affecting the decision of female students to enroll in undergraduate science, technology, engineering and mathematics majors in kazakhstan. *Int. J. Sci. Educ.* **2020**, *112*, 1–21.
36. Mamo, H.; Gosa, G.; Hailu, B. Perception of University Female Students on Factors Affecting Their Academic Performance and Competency: A Study from Dire Dawa University, Ethiopia. *Sci. J. Educ.* **2017**, *5*, 211. [CrossRef]
37. Hanson, S.L.; Krywult-Albańska, M. Gender and access to STEM education and occupations in a cross-national context with a focus on Poland. *Int. J. Sci. Educ.* **2020**. [CrossRef]
38. Balakrishnan, B.; Low, F.S. Learning experience and socio-cultural influences on female engineering students' perspectives on engineering courses and careers. *Minerva* **2016**, *54*,219–239. [CrossRef]
39. Lin, T.J.; Tsai, C.C. Differentiating the sources of Taiwanese high school students' multidimensional science learning self-efficacy: An examination of gender differences. *Res. Sci. Educ.* **2018**, *48*, 575–596. [CrossRef]
40. Lytle, A.; Shin, J.E. Incremental Beliefs, STEM Efficacy and STEM Interest Among First-Year Undergraduate Students. *J. Sci. Educ. Technol.* **2020**, *29*, 1–10. [CrossRef]
41. Fernández-Cézar, R.; Garrido, D.; García-Moya, M.; Gómezescobar, A.; Solano-Pinto, N. Equity or Stereotypes in Science Education? Perspectives from Pre-University Students. *Sustainability* **2020**, *12*, 9354. [CrossRef]
42. Mersha, Y.; Bishaw, A.; Tegegne, F. Factors affecting female students' academic achievement at Bahir Dar University. *J. Int. Coop. Educ.* **2013**, *15*, 135–148.

43. Yigermal, M.E. Determinant of Academic Performance of Under Graduate Students: In the Cause of Arba Minch University Chamo Campus. *J. Educ. Pract.* **2017**, *8*, 155–166.
44. Gilar-Corbi, R.; Pozo-Rico, T.; Juan-Luis, C.; Sánchez, T.; Sandoval-Palis, I.; Vidal, J. Academic Achievement and Failure in University Studies: Motivational and Emotional Factors. *Sustainability* **2020**, *12*, 9798. [CrossRef]
45. Riegle-Crumb, C.; Moore, C. Examining gender inequality in a high school engineering course. *Am. J. Eng. Educ.* **2013**, *4*, pii:7858. [CrossRef] [PubMed]
46. Van den Hurk, A.; Meelissen, M.; van Langen, A. Interventions in education to prevent STEM pipeline leakage. *Int. J. Sci. Educ.* **2019**, *41*, 150–164. [CrossRef]
47. Patall, E.A.; Steingut, R.R.; Freeman, J.L.; Pituch, K.A.; Vasquez, A.C. Gender disparities in students' motivational experiences in high school science classrooms. *Sci. Educ.* **2018**, *102*, 951–977. [CrossRef]
48. Hosaka, M. Women's experiences in the engineering laboratory in Japan. *Eur. J. Eng. Educ.* **2014**, *39*, 424–431. [CrossRef]
49. García Villa, C.; González y González, E.M. Women students in engineering in Mexico: Exploring responses to gender differences. *Int. J. Qual. Stud. Educ.* **2014**, *27*, 1044–1061. [CrossRef]
50. Molla, T.; Cuthbert, D. Qualitative inequality: Experiences of women in Ethiopian higher education. *Gend. Educ.* **2014**, *26*, 759–775. [CrossRef]
51. World Economic Forum. Why We Need More Women in Technology by 2030 and How to Do It 2017. Available online: https://www.weforum.org/agenda/2017/11/women-in-tech-engineering-ellen-stofan/ (accessed on 17 December 2020).
52. Egne, R.M. Gender equality in public higher education institutions of Ethiopia: The case of science, technology, engineering, and mathematics. *Discourse Commun. Sustain. Educ.* **2014**, *5*, 3–21. [CrossRef]
53. Lin, T.; Lv, H. The effects of family income on children's education: An empirical analysis of CHNS data. In Proceedings of the 4th International Conference on Information Technology and Career Education Asian, Hangzhou, China, 15–16 April 2017; pp. 49–54.
54. Tomul, E.; Çelik, K. The relationship between the students' academic achievement and their socioeconomic level: Cross regional comparison. *Procedia-Soc. Behav. Sci.* **2009**, *1*, 1199–1204. [CrossRef]
55. Li, Z.; Qiu, Z. How does family background affect children's educational achievement? Evidence from Contemporary China. *J. Chin. Sociol.* **2018**, *5*, 13. [CrossRef]
56. Gobena, G.A. Family Socio-Economic Status Effect on Students' Academic Achievement at College of Education and Behavioral Sciences, Haramaya University, Eastern Ethiopia. *J. Teach. Educ. Educ.* **2018**, *7*, 207–222.
57. Buchmann, C.; DiPrete, T.A. The growing female advantage in college completion: The role of family background and academic achievement. *Am. Sociol. Rev.* **2006**, *71*, 515–541. [CrossRef]
58. Carnasciali, M.I.; Thompson, A.E.; Thomas, T.J. Factors influencing students' choice of engineering major. *Inf. Syst. Educ. J.* **2013**, *134*, 31–36.
59. Choudhury, P.K. Explaining gender discrimination in the employment and earnings of engineering graduates in India. *J. Educ. Plan. Adm.* **2015**, *29*, 225–246.
60. Sjaastad, J. Sources of Inspiration: The role of significant persons in young people's choice of science in higher education. *Int. J. Sci. Educ.* **2012**, *34*, 1615–1636. [CrossRef]
61. Leavey, N.J. Mentoring Women in STEM: A Collegiate Investigation of Mentors and Protégés. Doctoral Dissertation, The Graduate School, Stony Brook University, Stony Brook, NY, USA, 2016.
62. Shin, J.E.L.; Levy, S.R.; London, B. Effects of role model exposure on STEM and non-STEM student engagement. *J. Appl. Soc. Psychol.* **2016**, *46*, 410–427. [CrossRef]
63. Chachashvili-Bolotin, S.; Milner-Bolotin, M.; Lissitsa, S. Examination of factors predicting secondary students' interest in tertiary STEM education. *Int. J. Sci. Educ.* **2016**, *38*, 366–390. [CrossRef]
64. Ethiopia Ministry of Education. *Education and Training Policy*; George Printing Press: Addis Ababa, Ethiopia, 1994. Available online: https://www.cmpethiopia.org/media/education_and_training_policy_ethiopia_1994 (accessed on 4 December 2020).
65. Del Águila, M.R.; González-Ramírez, A.R. Sample size calculation. *Allergol. Immunopathol.* **2014**, *42*, 485–492. [CrossRef]
66. Witherspoon, E.B.; Schunn, C.D. Locating and understanding the largest gender differences in pathways to science degrees. *Sci. Educ.* **2020**, *104*, 144–163. [CrossRef]
67. Eccles, J.S.; Wang, M.T. What motivates females and males to pursue careers in mathematics and science? *Int. J. Behav. Dev.* **2016**, *40*, 100–106. [CrossRef]
68. Mohamad, M.M.; Sulaiman, N.L.; Sern, L.C.; Salleh, K.M. Measuring the validity and reliability of research instruments. *Procedia Soc. Behav. Sci.* **2015**, *204*, 164–171. [CrossRef]
69. Wooldridge, J.M. *Introductory Econometrics: A Modern Approach*; Nelson Education Ltd.: Toronto, ON, Canada, 2016.
70. Ethiopia Ministry of Education; Federal Democratic Republic of Ethiopia; Ministry of Education. Educational Statistics Annual Abstract Report. 2016. Available online: http://www.moe.gov.et/statistics (accessed on 19 August 2020).
71. UNESCO. Education Database. 2020. Available online: http://data.uis.unesco.org/ (accessed on 21 June 2020).
72. Cebr for the Royal Academy of Engineering. Engineering and Economic Growth: A Global View. 2016. Available online: https://www.raeng.org.uk/publications/reports/engineering-and-economic-growth-a-global-view (accessed on 15 January 2021).

73. Gupta, N. Women undergraduates in engineering education in India: A study of growing participation. *Gender Technol. Dev.* **2012**, *16*, 153–176. [CrossRef]
74. National Science Foundation. Women, Minorities, and Persons with Disabilities in Science and Engineering. 2017. Available online: https://ncses.nsf.gov/pubs/nsf19304/ (accessed on 15 January 2021).