Gender Inequality in Employability and Earnings among Early-Career Engineers. A case study of two universities from Colombia and Ecuador.

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Abstract*– Globally, there is a gender gap in STEM fields. Despite the efforts made, women are still underrepresented in STEM academic programs and in the workforce. This study analyzes gender gaps in graduation, employability, time to labor market insertion, and wages among early-career engineers from two universities in Latin America: Universidad Tecnológica de Bolívar (UTB) in Colombia and Escuela Superior Politécnica del Litoral (ESPOL) in Ecuador. We used graduate survey data from 2016–2023 at UTB and from 2020–2024 at ESPOL, focused on eight engineering programs that are common in both universities. Results show persistent underrepresentation of women, who represent 33% of UTB and 27% of ESPOL graduates. Gender disparities are more pronounced in disciplines such as Electrical, Mechanical, and Mechatronics Engineering, while Industrial and Chemical Engineering show more balanced participation. Employability outcomes were similar across genders (UTB: 81% men, 79% women; ESPOL: 84% men, 85% women). Women at UTB took longer to find their first job, while women at ESPOL entered the labor market faster than men. Salary data reveal significant gender pay gaps: men who graduated from UTB and ESPOL are more likely to earn higher salaries than their women colleagues. These findings reflect global trends of unequal economic opportunities despite equivalent education. There is a need for institutional policies and strategies to promote female inclusion, equal pay, and career development in STEM fields.

Keywords*—Labor market insertion, STEM, Gender pay gap, Graduates, Colombia-Ecuador, Women in Engineering.

I. Introduction

The gender gap continues to be one of the most significant social and economic challenges of the 21st century. Although progress has been made in recent years in terms of women's representation in various fields, including the workforce, inequalities still persist that limit their full and equal participation in society [1]. Women are still underrepresented in STEM (Science, Technology, Engineering, and Mathematics) careers. According to the Global Gender Gap Report 2024, the representation of women in STEM jobs was only 28.2% globally [1]. In 2021, in the United States, women were 34.6% of the STEM workforce, according to the Census Bureau, American Community Survey, while in the European Union, women were 41.0% of the scientists and engineers in 2023 [2].

Latin America is the region that has made the most significant overall progress toward gender parity since 2006. In 2025, Ecuador ranked 25th, and Colombia ranked 41st out of 148 countries in the Global Gender Gap Index [3]. However, this progress does not translate equally across all sectors, and female participation in STEM careers remains low. A study conducted in 2020 with six Latin American universities found that, in 2018, women were 34% of the graduates in engineering, and 52% of the graduates in natural sciences, mathematics, and statistics [4]. Therefore, the gender gap was prominent in engineering and not evident in basic sciences. Another study conducted in Ecuador evidenced the low participation of women in STEM fields and identified that individuals living in rural areas and from low-income families are more likely to pursue STEM programs [11]. Currently, in Latin America, 41% of STEM graduates are women, and inequalities persist in the workplace [3].

There are psychological and sociocultural factors that contribute to occupational segregation and promote the gender gap in STEM. Some of them are stereotypes, beliefs, self-efficacy, family background, socioeconomic context, interests, goals, confidence, external support, masculinity, occupational aspirations, burnout, well-being, academic performance, self-perceived skills, and influence of the job market [5]. Several strategies have been developed in Latin America to promote the attraction, access, and retention of women in STEM higher education programs [6, 12]. However, once women graduate from university, they face challenges in their transition to the labor market in STEM, such as hiring bias and caregiving responsibilities, which can limit their career development.

The Global Gender Gap Report 2025 notes that although women have greater access to higher education, significant inequalities persist in career choices and the economic opportunities derived from these academic pathways. Notably, the report reveals that women earn an average of only 68% of men's income for equal work, indicating that equity in graduation does not necessarily lead to equality in employability or wages [3]. A recent study in Spain found that women take 16.6% more time than men to find a job in STEM. In addition, female STEM graduates earn almost 100€ less than their male counterparts [7].

This article explores gender gaps in graduates, employability, time for labor insertion, and earnings by gender among early career engineers from two universities in Ecuador and Colombia.

The institution in Colombia is Universidad Tecnológica de Bolívar (UTB), a private university located in Cartagena, on Colombia's Caribbean coast. Since its founding, UTB has been

strong in engineering education. Currently, UTB has 11 undergraduate programs and 21 graduate programs in engineering. Cartagena has one of the country's main industrial and logistics centers and has been consolidated as a hub for international trade. The industrial sector is characterized by a strong petrochemical and plastics cluster, anchored by the Cartagena Refinery and complemented by shipbuilding, food processing, and manufacturing industries.

The institution in Ecuador is Escuela Superior Politécnica del Litoral (ESPOL), a public university located in Guayaquil. ESPOL offers a wide range of applied science and engineering programs, accredited by the ABET Engineering Accreditation Commission and/or the EUR-ACE label by the European Network for Accreditation of Engineering Education (ENAEE). The academic offer includes 18 undergraduate and 19 graduate programs in engineering and technology. Guayaquil is the main port city and the center of commerce and industry in Ecuador. Its economy is strongly linked to international trade, particularly agricultural commodities such as bananas, shrimp, and cocoa. The city also has a diversified industrial base that includes food processing, textiles, chemicals, shipbuilding, and construction materials.

We used data from the universities' alumni offices to identify similarities and differences in the employability of their female and male graduates. As both universities are located on the coast, close to important logistics and industrial centers, their graduates encounter similar environments for their professional development.

II. Methodology

To evaluate the labor market insertion among graduates, UTB applies a virtual survey to its alumni every two years. We analyzed the survey that was applied from November 2023 to May 2024 and included graduates from 2016 to 2023. In this study, we considered data from alumni of eight engineering programs that are offered at both universities: civil, electrical, electronic, industrial, mechanical, mechatronics, and naval engineering. From a total population of 1738 graduates of those programs, a sample size of 362 was taken (21%).

The data for ESPOL was obtained from the graduate tracking process conducted annually from 2020 to 2024. From a total population of 3694 graduates, a sample of 1,083 responses (29%) from graduates of the focus degree programs of the present study was taken.

The responses of the surveys were analyzed to characterize four aspects: gender gap in graduates, employability, time to find a job, and earnings, and the results are shown in the next section.

III. Results and Discussion

A. Graduates

Fig. 1 and Fig. 2 show the percentage of women and men graduates per engineering programs in UTB and ESPOL, respectively.

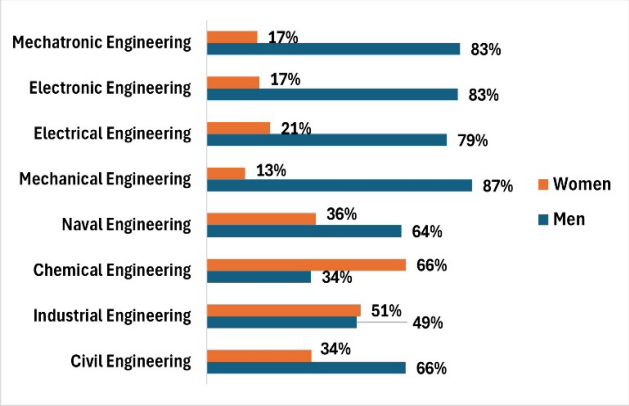

Fig. 1 UTB Graduates (2020-2023)

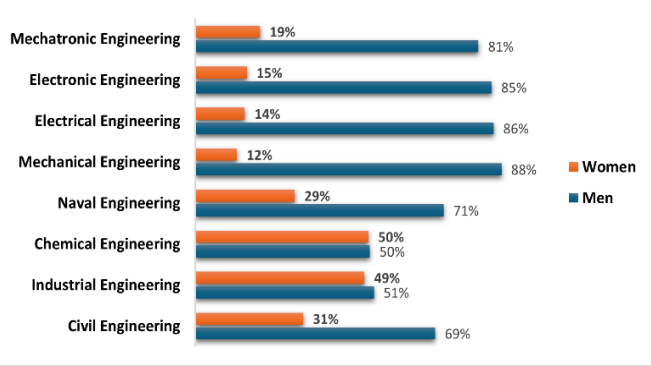

Fig. 2. ESPOL Graduates (2020-2023)

As shown in Figs. 1 and 2, the degrees in Electrical, Electronics, Mechatronics, and Mechanical Engineering had the lowest percentage of female graduates, both at UTB and ESPOL. This reflects the global trend of women being underrepresented in these areas, highlighting the persistence of gender stereotypes and barriers to access in specific disciplines that are considered masculinized. In particular, these programs can be regarded as physically demanding or having workplace environments that can be hostile or unsupportive to women. In addition, there is low visibility for women in these fields.

Regarding Civil and Naval engineering, these programs do not show a gender gap as wide as the previous programs, but the number of men is still about twice that of women.

By contrast, the degrees in Industrial and Chemical Engineering show a more balanced gender distribution. Industrial engineering involves applications in management, systems optimization, human resources, and processes, often perceived as more interdisciplinary and less masculinized, making them more interesting to women. Chemical engineering involves processes related to life sciences, the environment, and production, which may better align with societal goals. Previous studies have shown that women are more interested in engineering fields related to caring for others and solving societal problems [8]. It is remarkable that even across

engineering fields, both men and women have career preferences that align with gender stereotypes [8].

Figs. 3 and 4 show the shares of female and male graduates in UTB and ESPOL, respectively.

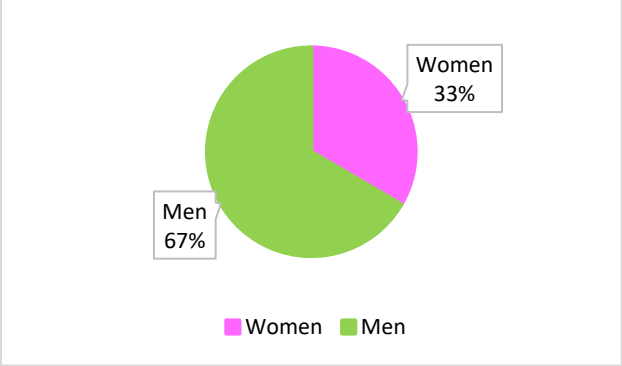

Fig. 3 Share of UTB women and men graduates (2020-2023)

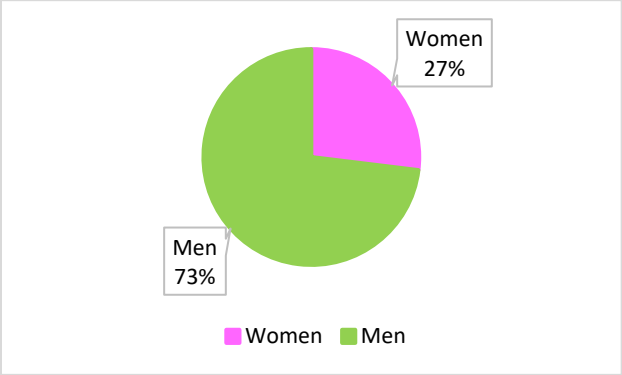

Fig. 4. Share of ESPOL women and men graduates (2020-2023)

In the case of UTB, of the total number of engineering graduates from 2020 to 2023, only 35% were women. ESPOL shows a comparable trend, with women comprising only 27% of graduates from 2020 to 2023. These results reflect a notable gender gap in participation and economic opportunities, where structural inequalities limit the use of female talent in key innovation and development sectors.

B. Employability

The survey asked the participants if they currently had a job. Their employment status could include being an employee, self-employed, business owner, or entrepreneur. The results for UTB and ESPOL are shown in Figs. 5 and 6. In the case of UTB, there is a limitation with the data; some programs have a small number of graduates (Naval, Chemical, Electrical, and Electronic), so the percentages show either 100% or a low number. The results show that in UTB, the employability of women is lower in Civil Engineering, and comparable or better in the other programs.

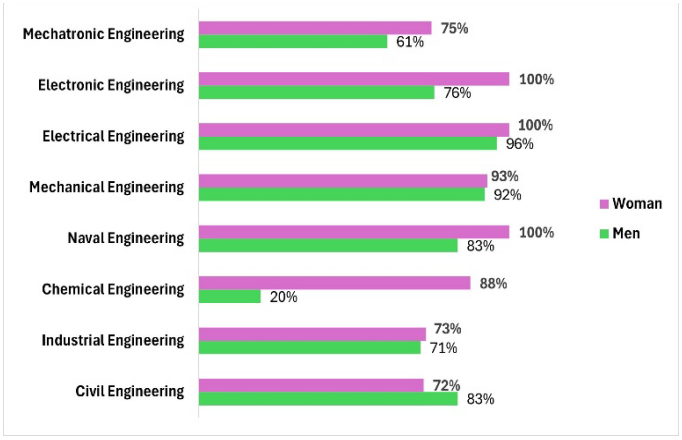

Fig. 5. UTB Employability

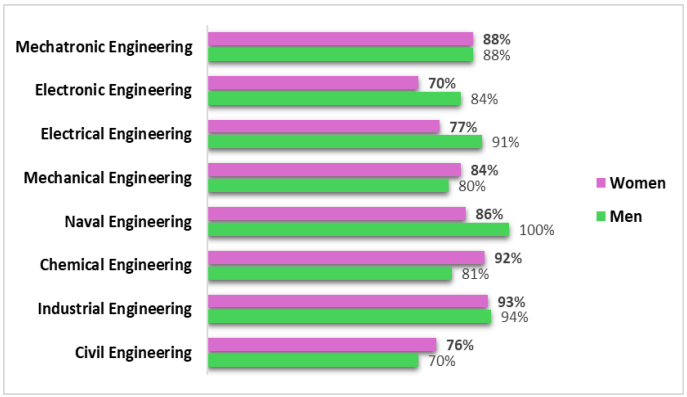

Fig. 6. ESPOL Employability

In ESPOL, electrical engineering shows a significant difference, with 91% of men employed compared to 77% of women. In fields such as industrial engineering, there are excellent job prospects for both men and women, which is a significant incentive for more women to choose that program. It is important to note that these figures should be interpreted in light of the unequal size of the populations. In programs with predominantly male enrolment, such as Electrical Engineering, percentage comparisons are influenced by the lower representation of women. Thus, while the percentages indicate a disparity in employability, an analysis of the absolute numbers reveals that the small number of women exacerbates the perception of disparities. This scenario highlights the importance of encouraging greater female participation in traditionally male-dominated fields, both to achieve gender balance and to enable women to access sectors where they can enter the labor market with significant advantages.

Considering the total number of participants from the eight engineering programs, the employability of UTB graduates was similar between genders (81% men, 79% women). Similarly, in ESPOL, employability outcomes show no significant gender gap, with rates of 84% for men and 85% for women.

These findings show the need to identify the factors that affect the professional development of women in STEM.

C. *Employment status since graduation*

At UTB and ESPOL, there are mandatory industrial internships in the last academic semester of the engineering curriculum. This is a key factor that promotes the development of disciplinary and interpersonal skills and fosters employability. Fig. 7 shows the time it takes for UTB graduates to find their first job. It is notable that for 39% of men and 42% of women, their first job is in the company where in the companies where they developed the internships. 82% of men and 74% of women reported they found a job before graduating or within 6 months after graduation. Therefore, women, on average, spend more time looking for a job than men. By contrast, at ESPOL, 87.7% of women find employment within six months of graduating, compared to 84% of men, as seen in Fig. 8. These figures show a trend opposite to that of UTB. It is observed that female ESPOL engineering graduates can get a job even faster than their male counterparts, as companies are often interested in promoting inclusive workplace environments, and there is a smaller number of women engineering graduates.

Fig. 7. Time to find the first job for UTB graduates

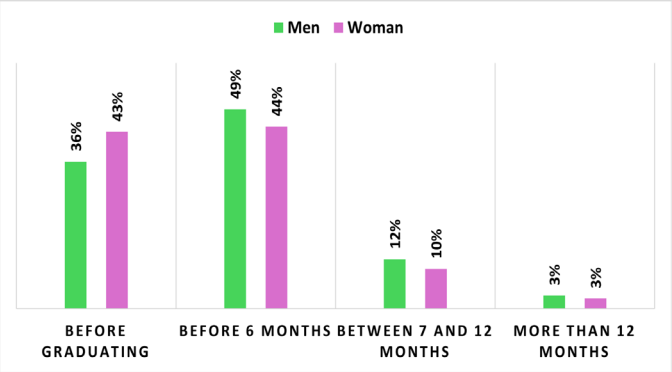

Fig. 8. Time to find the first job for ESPOL graduates

D. *Salaries*

According to the Global Gender Gap Report 2025, women earn only 68% of men's income for work of equal value globally, reflecting structural inequality in economic remuneration [1]. Most of the countries in the world, including Colombia and Ecuador, have adopted pay equity laws. However, only one in five economies with legislation that enforces equal pay for equal work have also implemented mechanisms to redress the pay gap [1]. National laws on equal payment for women and men in Latin America require equal remuneration for equal work in terms of skills, effort, and abilities under the same conditions. Colombia's constitution and labor laws guarantee equal pay for equal work and protect against gender-based wage discrimination. Ecuador's constitution and labor code also require equal pay and include a living wage guarantee covering basic worker needs.

Fig. 9 shows the remuneration of UTB engineering graduates. The salaries are expressed in terms of the National Minimum Wage (NMW) in Colombia during 2023, which was the year of the study. Even though for both men and women most of the wages fall in the range 1,3 to 3.0 NMW, we can see that men's wages are more spread towards higher salaries compared to women's wages. It is evident that a pay gender gap exists, as 16.1% of men and 8.2% of women earn more than 4,7 NMW.

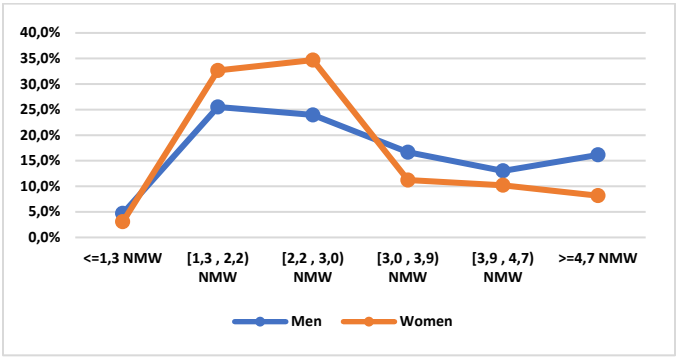

Fig. 9. UTB graduates' salary ranges

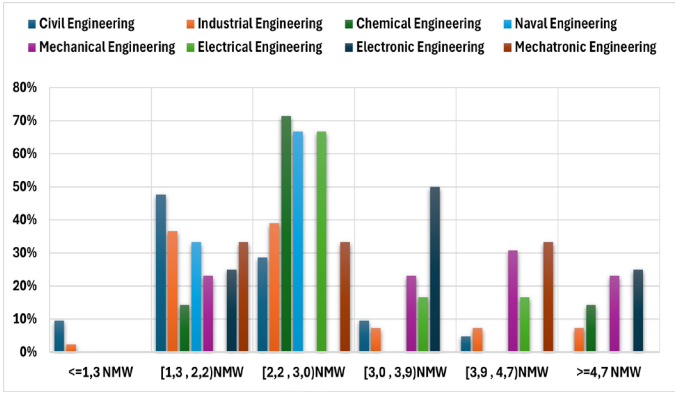

Fig. 10. UTB Women graduates' salary ranges

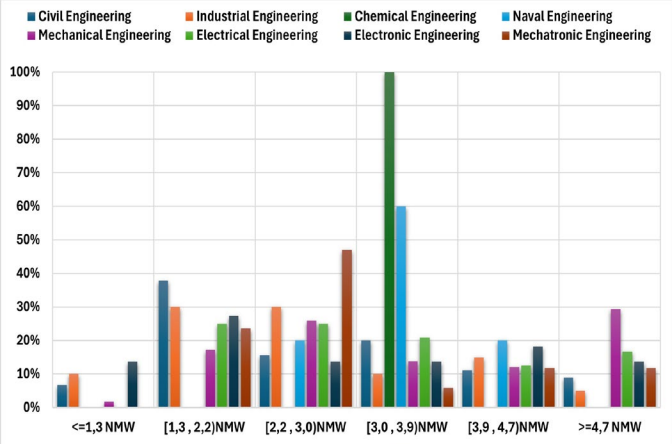

Fig. 11. UTB Men graduates' salary ranges

Figs. 10 and 11 show the wage distribution for women and men engineers from UTB. It can be observed that, in the case of women, the lowest salaries are mostly from civil engineers, while the highest salaries are from electronic, chemical, and mechanical engineers. In the case of men, civil engineers appear in the low wage ranges, but also in the top ranges, so their distribution is more uniform. The highest salaries are reported by mechanical, electrical, electronic, and mechatronic engineers.

Fig. 10 shows the salary distribution of ESPOL engineering graduates expressed also in terms of the NMW of Ecuador. ESPOL data show that men receive an average of 2.86 NMW, compared to 2.56 NMW for women. This difference highlights the persistence of a gender pay gap.

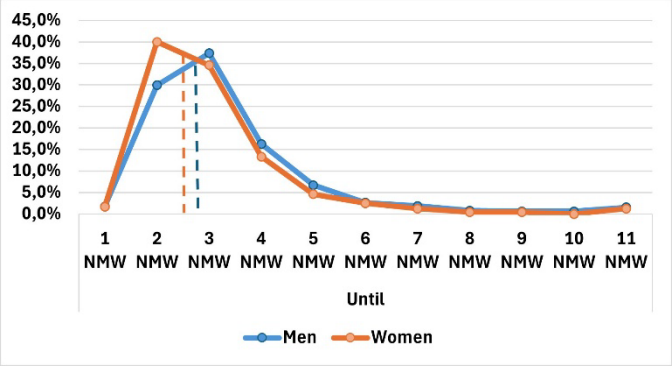

Fig. 12. ESPOL graduates' salary ranges

When these results are compared, it becomes clear that the wage gaps at UTB and ESPOL are consistent with the global trend described by the WEF: even with similar levels of education, women face disadvantages in terms of wages and access to better job positions.

There are multiple causes for the pay gender gap. Hiring and remuneration practices and policies can be inherently biased if there is manager discretion. Conscious and unconscious biases affect hiring, promotion, salary negotiations, and performance evaluations. Women may receive lower starting salaries, fewer high-paying assignments, or face barriers to bonuses [9]. In addition, women can be affected by the "motherhood penalty", which can difficult promotions, and are more likely to work part-time or flexibly to balance life and work [9]. Organizations must be attentive to avoid gender bias and discrimination, promote equal promotion and remuneration [13]. Monitoring should be done to oversee compliance with labor equity laws and the creation of policies and programs with a gender perspective, as well as actions for work-life and family balance. In the case of UTB, there is a protocol for the prevention and management of gender-based violence [11]. These policies aim to offer safe workplaces that promote women's development.

IV. Conclusions

The purpose of this study was to analyze employability, labor market insertion, salary range, and graduation in eight STEM programs at a Colombian and an Ecuadorian university to identify gender gaps. Results show persistent underrepresentation of women, who are 33% of UTB and 27% of ESPOL graduates. Employability rates are comparable across genders (UTB: 81% men, 79% women; ESPOL: 84% men, 85% women), though women generally take longer than men to find jobs at UTB, while at ESPOL, women find employment faster than men. Salary comparisons highlight significant disparities: UTB men are more likely to earn above 4.7 times the minimum wage, and ESPOL men earn, on average, 0.3 times the minimum wage more than women. These results confirm that the gender gap persists, and there is a need to implement institutional strategies that promote female employability and career development in STEM, such as mentoring programs and skills development.

This study can provide solid and contextualized information to help evaluate and promote gender equality policies in higher education institutions and the STEM labor market. The gender gap among graduates, time for employment, and wages shows the need for promoting STEM vocations among women, designing support programs for labor insertion, and promoting gender equality in STEM companies. The study can also help understand how gender gaps evolve for graduates from UTB and ESPOL, allowing public policies to be guided to promote equal pay and improve female labor market insertion.

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