

# Women's computer science entrepreneurship: case study UTPL

Rodríguez-Morales Germania<sup>1</sup>, Segarra-Morales Soledad<sup>1</sup>, Soto Guerrero Fernanda<sup>1</sup> and Cueva Carrión Samanta<sup>1</sup>

<sup>1</sup> Universidad Técnica Particular de Loja, San Cayetano, Loja, Ecuador

## Abstract

The participation of women in science, technology, engineering and mathematics (STEM) fields, despite efforts, falls short of achieving equitable representation. Entrepreneurship emerges as a sustainable option for economic development in today's society; however, women entrepreneurs in the field of computer science are scarce compared to men, who dominate this domain. This study conducts a comparative and descriptive analysis of female computer science students. Their labor participation and motivations and limitations for entrepreneurship in their field of study are examined. The results indicate that, generally, women do not find employment related to their field of study, and their primary motivation for entrepreneurship is to fulfill their economic needs. Unlike men, women entrepreneurs also seek to generate employment for others and value schedule flexibility. It is important to note that this study is limited to students from a specific university in Ecuador.

## Keywords

Women, computer science women, entrepreneurship, entrepreneurship in university environments, entrepreneurship in higher education

## 1. Introduction

In the field of science, technology, engineering and mathematics (STEM), the male gender has been predominant since time immemorial [1]. The lack of women in STEM careers is a problem that affects all higher education institutions, not only in Latin America but also in Europe and other regions of the world [2]. Entrepreneurship improves economies and people's lives, creates jobs, solves problems, develops technology that improves efficiency and the exchange of ideas on a global scale [3]. Women's participation in entrepreneurship is significantly lower than that of men in almost all countries of the world [4]. Despite the relevance of the entrepreneurial role of universities for economic and social development and the particular attention of women entrepreneurs to these aspects, studies on the subject are still scarce and fragmented [5]. This is reflected in the scarce presence of women in the labor and business fields related to computer sciences.

The most common factors that limit people's interest in entrepreneurship, such as financial risks or high responsibilities, may not be related to gender; but there are also aspects such as social acceptance, discrimination and lack of role models, which especially affect women interested in becoming an entrepreneur in technology [6]. There are studies that claim that this behavior is based on the differentiated upbringing style that men and women have and that affects their entrepreneurial spirit and that entrepreneurial intentions depend on the cultural context of their country or region [7]. Narratives about women entrepreneurs' experiences or role models decrease race, class and age barriers; they reduce prevailing gender stereotypes, discriminatory labor treatment and show entrepreneurship as a suitable alternative for working mothers [8].

---

Proceedings XV Congress of Latin American Women in Computing 2023, October 16–20, 2023, La Paz, Bolivia

EMAIL: grrodriguez@utpl.edu.ec; mssegarra@utpl.edu.ec; fmsoto@utpl.edu.ec; spcueva@utpl.edu.ec

ORCID: 0000-0001-8932-9213; 0000-0001-9657-4532; 0000-0003-3097-9291; 0000-0003-3862-8816



© 2023 Copyright for this paper by its authors.

Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

CEUR Workshop Proceedings (CEUR-WS.org)

As main results it was found that female students of computer science careers of the Universidad Técnica Particular de Loja (UTPL) have the intention to start their entrepreneurship that generates independence and growth, focused on professional services, some consider their main barrier the lack of funding, self-confidence and motivation to develop their entrepreneurship and the need for specific training, based on the type of venture chosen, it is not the same a manufacturing venture to a services venture.

Women face greater obstacles than their male counterparts in entering the labor market, gaining access to quality jobs, sustaining their work trajectories and occupying decision-making positions. This is accentuated in some sectors of the economy that usually offer better paying jobs, with less informality, and are more dynamic and innovative. In particular, the field of science, technology, engineering and mathematics (STEM) is one of the sectors with the lowest female participation, and also one of the most relevant in the framework of the Fourth Industrial Revolution. [9]

## 2. Methodology

For this research, a methodology composed of quantitative and qualitative analysis was applied, so that the results obtained can be complemented with both approaches. To begin with, existing information was collected in the databases of students and alumni of the STEM careers at UTPL, which allowed us to characterize the study population considering the following aspects: number of students in the careers, modality of study and number of women and men in each career.

Subsequently, to collect qualitative information, a semi-structured survey was designed based on instruments applied in similar studies. The survey is grouped in 3 sections: (i) personal and family information composed of 5 questions related to gender, age, career, marital status, number of family responsibilities (ii) work situation composed of 1 main question regarding the current work situation with four answer options: studying, students and working, working only and unemployed, if the answer includes the option working 8 questions related to their work are deployed, (iii) entrepreneurial conditions and environment, with 8 questions, 6 of them based on the methodology mentioned by [10] and 2 questions related to entrepreneurship training within the UTPL curriculum and with the entrepreneurship center of the same university.

The analysis sample is composed of 57 students of the careers related to computer science. The survey was applied to men and women in order to establish differentiated indicators that allow us to understand the behavior of students in relation to entrepreneurship and job performance, with different curricular training. The survey was applied between January 27, 2023 and March 2, 2023.

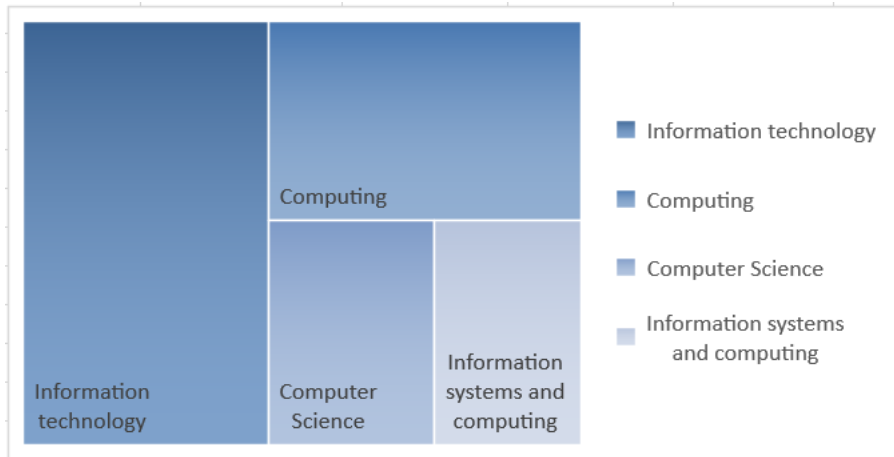
The survey was developed in the ArcGIS Survey123<sup>2</sup> tool in order to facilitate the collection of data and to be completed online. In order to apply the survey, it was sent to the students through the Whatsapp groups that the research teachers maintain with their students. For the analysis of the information, the descriptive and comparative statistical methods were used.

## 3. Results

The 57 responses obtained are distributed among students of computer science, information systems and computing careers offered in face-to-face modality in Loja city located in the highlands of Ecuador with about 170,000 inhabitants, and information technology and computer science careers offered in distance learning mode distributed in 12 cities in the three regions of the coast, highlands and east of Ecuador, Figure 1 shows the distribution of students by career.

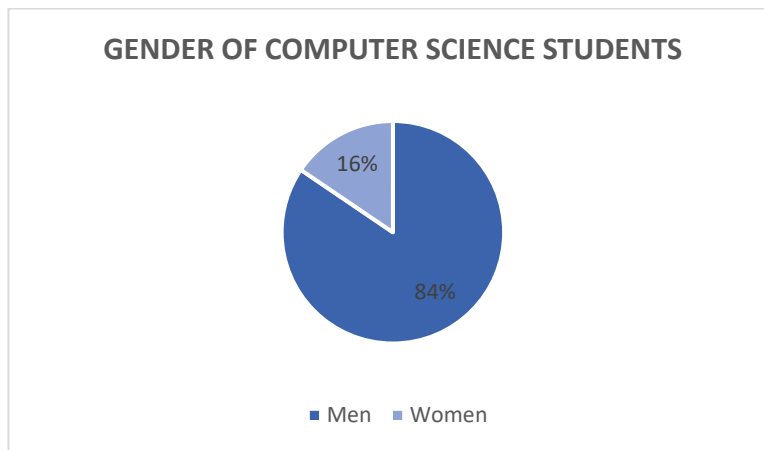
---

<sup>2</sup> <https://survey123.arcgis.com/>



**Figure 1:** Distribution of responses of UTPL computer science students by degree program

The personal and family information of the students allows us to have a context of the research, the responses obtained from students of computer science careers in general are composed of 16% women and 84% men, as shown in Figure 2.



**Figure 2:** Percentage distribution of computer science students by gender of the responses obtained.

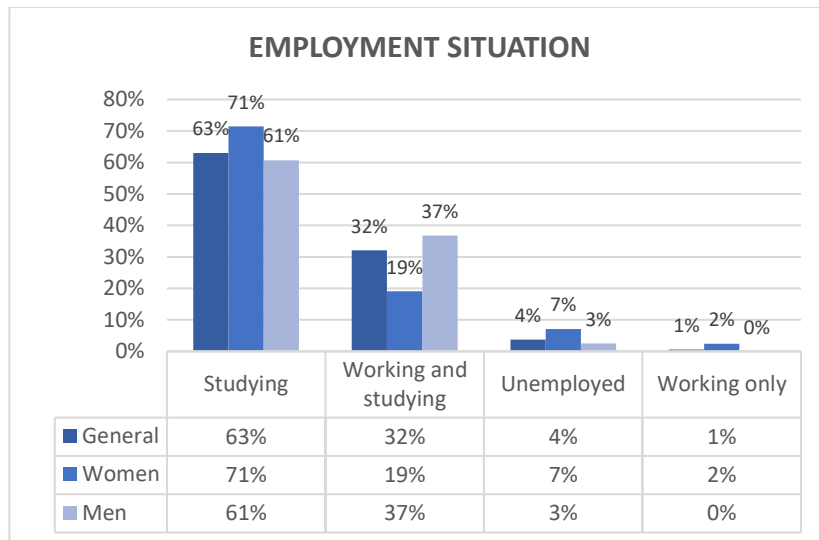
This is a young population, 51% are under 24 years of age, which added to the students in the range between 25 and 34 years of age, represent 77%. In the case of women, the average age is lower than the general trend, with 56% in the under 24 range and 89% in the 25-34 range.

In terms of family status, men and women are mostly single, 65%, while 30% are married and the other 5% are separated or in union. In the case of women, their marital status is higher than average and represents 78%, while 22% are married.

The average number of students with family responsibilities is 30.81%. In the case of women, 26% state that they have one family burden, 4.76% have three family burdens and another 4.76% have other family burdens, totaling 35.42%, which is higher than the general average for men and women.

### 3.1. Employment situation

Regarding the employment status of UTPL computer science students in general, the responses show that 63% of the students are studying only, while 32% are working and studying, 4% are unemployed and only 1% are working only. In the case of female students, 71% are studying, 19% are working and studying, 7% are unemployed and 2% are working only. These data are shown in Figure 3.

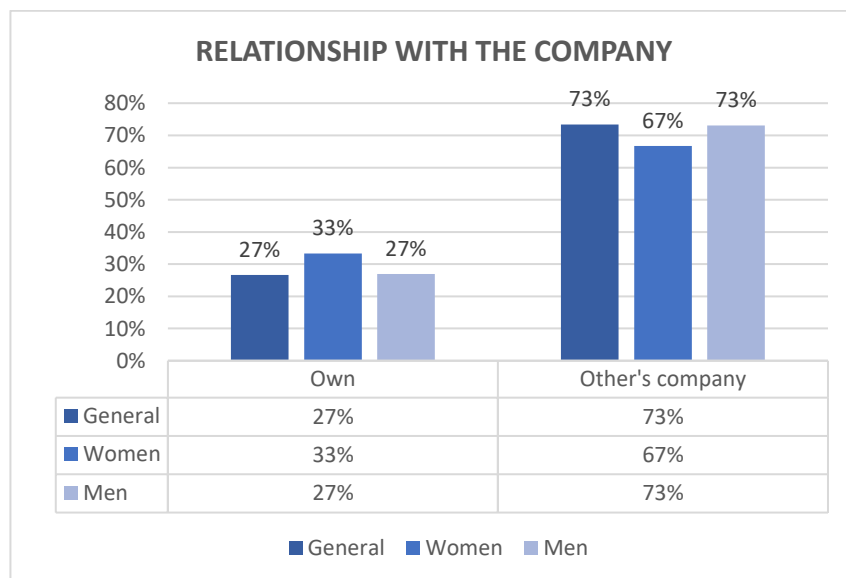


**Figure 3:** Employment status of UTPL computer science students

It is important to mention that the questions shown below were only answered by 30 of the 57 students, which represent 53% of the general sample, and they mentioned that they are working and studying, 7 in the on-site modality 23% and 23 in the distance modality 77%.

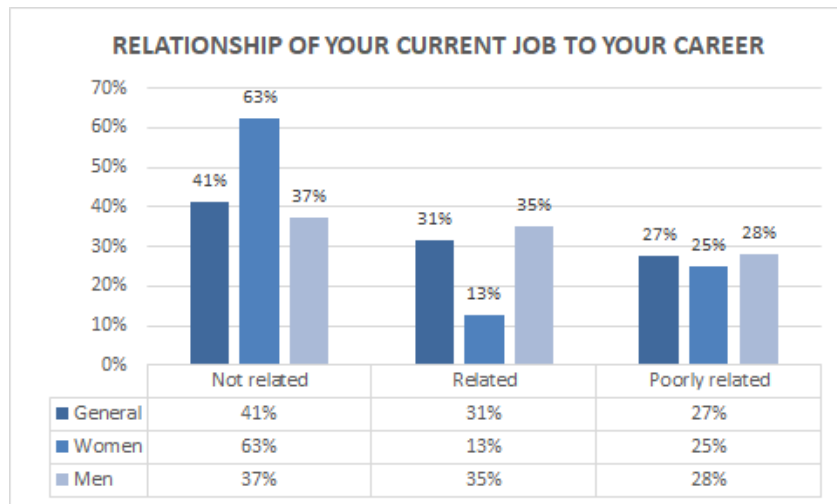
Regarding the type of company with which the computer science students are linked to work, 68% are linked to a private company and 32% to a public company; in the distance mode, 61% are linked to a private company and 39% to a public company. In the case of women, 100% are linked to a private company and in the distance mode 67% are linked to a private company and 33% to a public company.

Regarding the relationship with the company where they work, 73% work for a third-party company, while 37% work for their own company; in the case of women, 33% work for their own company. As shown in Figure 4.



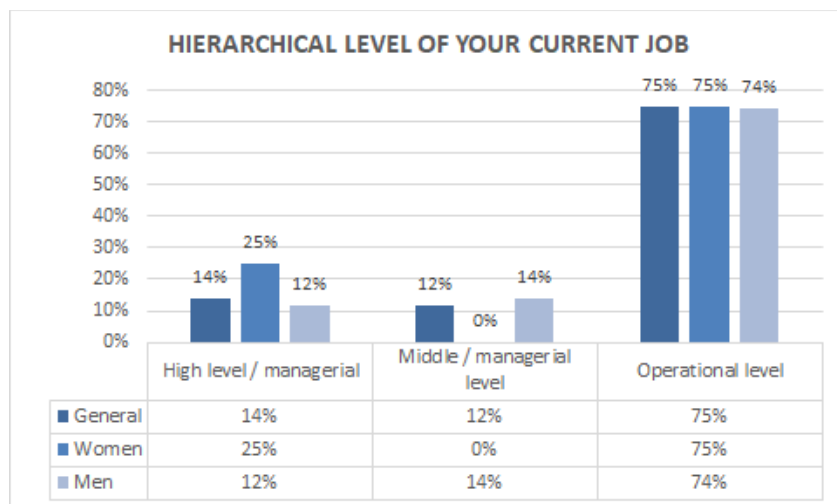
**Figure 4:** Relationship with the company.

Regarding the relationship of their current job with the career they are studying, 41% say that it is not at all related, 31% that it is related and 27% that it is not very related. In the case of women, 63% say nothing related, 13% say it is related and 25% say it is not very related, as shown in Figure 5.



**Figure 5:** Relationship between their current job and the career they are pursuing.

Regarding the level they occupy in the company where they work, 14% of them mentioned that they occupy a high/managerial level and 12% a middle/head level, and 75% are at the operative level. In the case of women, 25% mentioned that their work is at the senior/managerial level, while 75% are at the operational level and none are at the middle/management level. See Figure 6.



**Figure 6:** Hierarchical level of the work of UTP computer science students by gender.

To the question if they consider that the knowledge acquired in their career coincides with their current job, the answers obtained are shown in Figure 7, where 41% answer No, while 59% say yes. In the case of women, 75% said No and 25% said Yes.

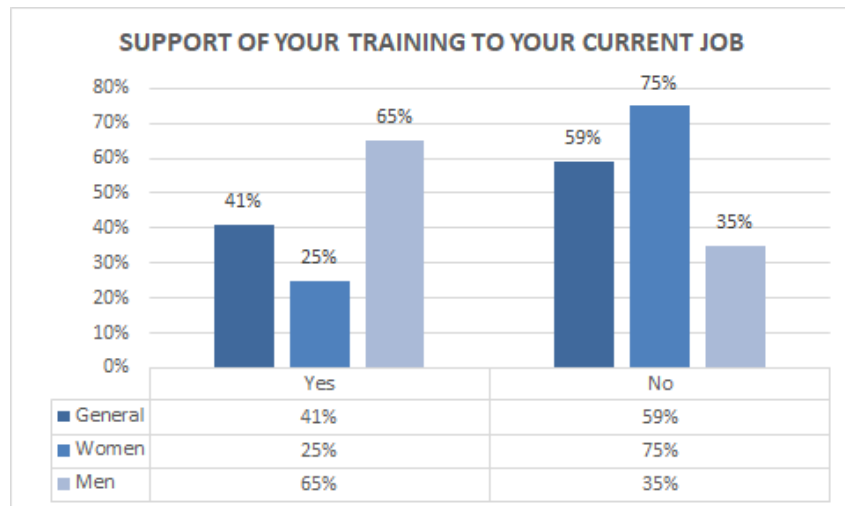


Figure 7: Contribution of the career to your current job.

### 3.2. Entrepreneurial conditions and environmental

Regarding entrepreneurial conditions and environment, the responses obtained show a partially favorable environment, some of the results obtained are shown below:

In the question if they have thought about creating their own company, the majority with 75% state that they have thought about it. In the case of women, 89% mentioned that they have thought about creating their own company, these data are shown in Figure 8.

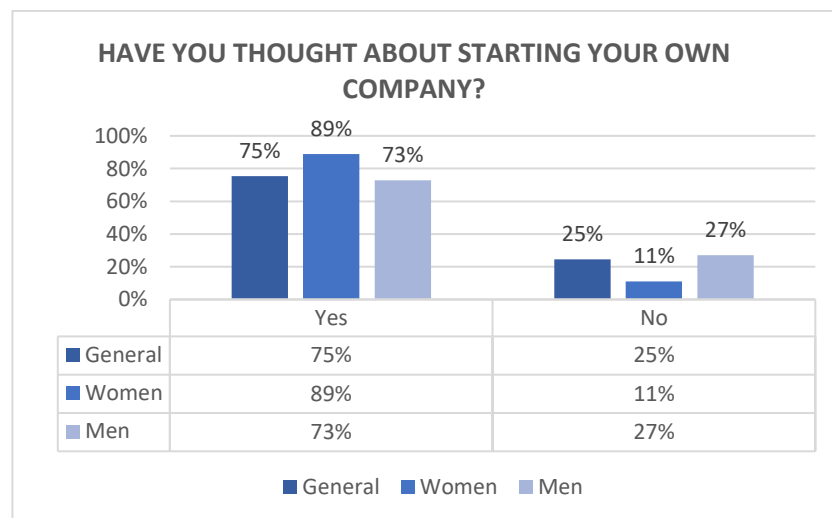


Figure 8: They have thought about creating their own business.

As for the motivations for entrepreneurship, it can be determined that the main ones are to improve income, which can provide financial independence, professional growth, since they have to manage all areas of the business and flexibility in the workday, and to be their own boss, as shown in Figure 9. Fifty-seven percent of the men and women surveyed have financial independence as their main motivation, for 32% their motivation is personal and professional growth, and 11% do it to generate employment mainly for their family; if we analyze only the responses of the women we have that 63% of their main motivation is financial independence, 25% are motivated by the generation of employment with their entrepreneurship and 13% do it for their personal growth.



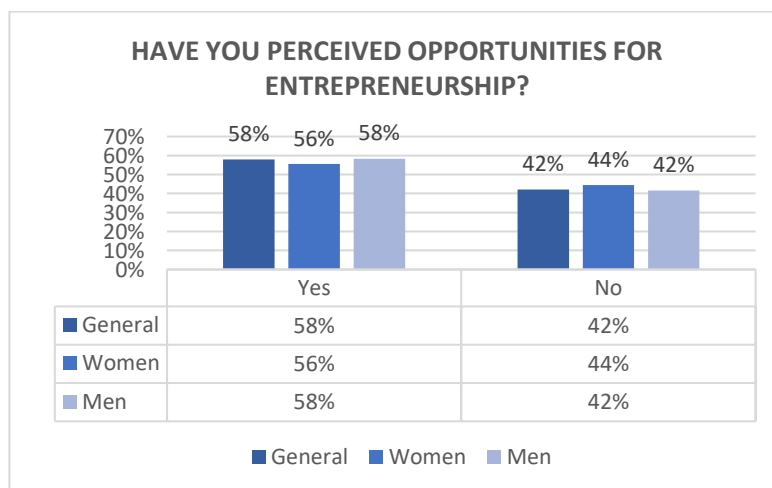
**Figure 9:** Cloud labels, responses of motivations for entrepreneurship.

On the other hand, the main limitations for entrepreneurship would be the lack of seed capital, lack of training to have a clear vision of the business in terms of entrepreneurship and marketing, including how much to invest, which markets to attack and which are your competitors, as well as the lack of knowledge of issues such as legislation, taxation and brands; another of the main limitations is motivation due to lack of self-confidence and security in their proposals, as shown in the word map in Figure 10. When analyzing the responses of men and women, 47% consider financing as their main limitation, 25% training and 27% motivation; however, when analyzing the responses of women, 40% consider financing as their main limitation, and 35% consider their own motivation, as well as 25% consider that they require more training to start their business.



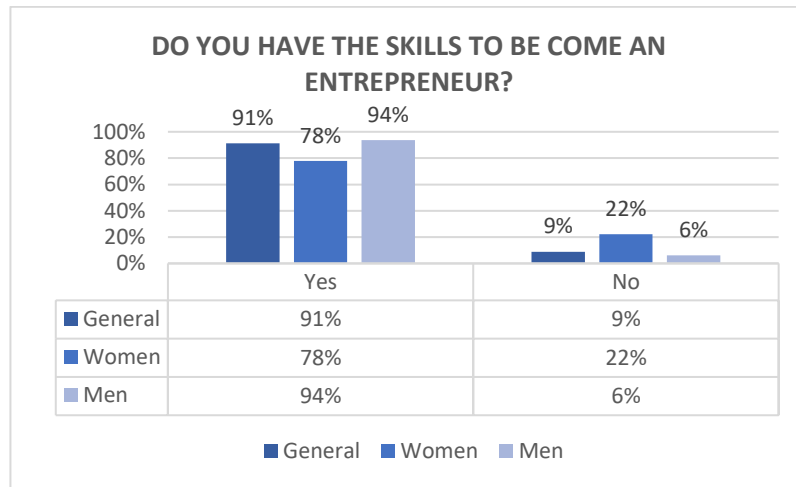
**Figure 10:** Cloud labels, responses, limitations to entrepreneurship.

On the other hand, when asked specifically if they have perceived opportunities for entrepreneurship, the results are shown in Figure 11, 58% respond that Yes they have perceived opportunities for entrepreneurship and 42% No. In the case of women, 56% say that Yes they have perceived opportunities for entrepreneurship, while 44% have not.



**Figure 11:** Have perceived opportunities for entrepreneurship

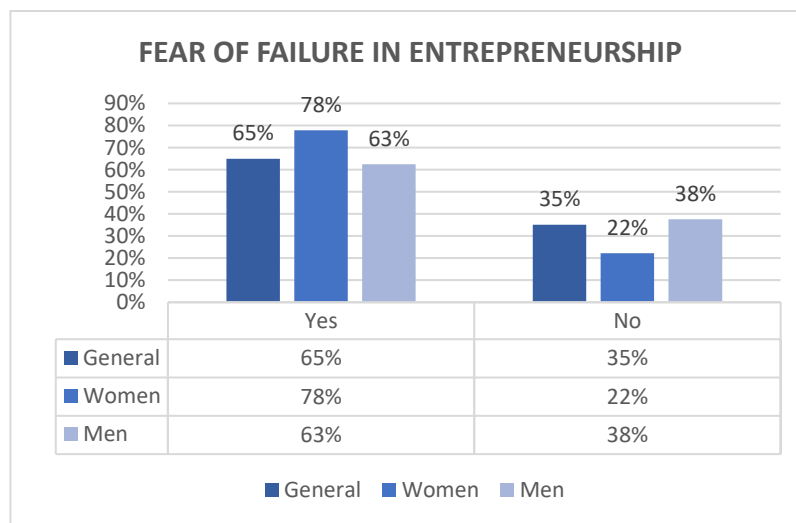
With respect to entrepreneurial skills, the results are shown in Figure 12: 91% of the computer science students state that they have the skills to undertake an entrepreneurial venture. While in the case of women, only 78% responded affirmatively to this question.



**Figure 12:** Consider that they have the skills to become an entrepreneur

Regarding whether they know another entrepreneur in their environment, 74% say that they do know another entrepreneur. While 78% of women answered affirmatively to this question.

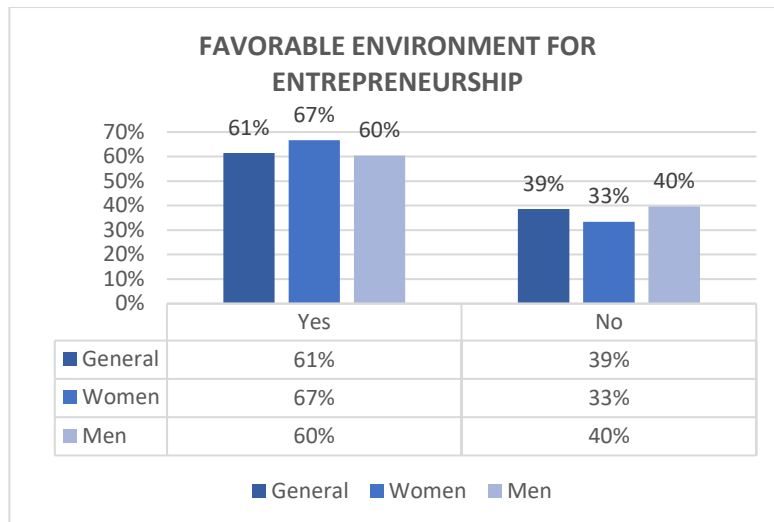
Another parameter considered in the instrument taken as a reference [10] is the fear of failure, the results are shown in Figure 13, where 65% of the students state that they are afraid of failure in the context of entrepreneurship, while 78% of the women answer yes to this question.



**Figure 13:** Fear of failure in the context of entrepreneurship.

Regarding the question of whether they consider that their environment has favorable conditions for entrepreneurship, 61% of the computer science students say yes. In the case of women, 67% say that their environment has favorable conditions for entrepreneurship. See Figure 14.





**Figure 14:** Favorable environment for entrepreneurship.

In the specific questions for the context of entrepreneurship at UTPL, for approximately 8 years, the subject of entrepreneurship has been included as a cross-cutting subject in all offerings, however, of those surveyed only 33% of the computer science students who responded to the instrument have taken the subject of entrepreneurship, coinciding in average percentage for men and women. Finally, it was asked if they have attended the entrepreneurship center of the University, the answer was No in all cases.

#### 4. Conclusions

After the analysis carried out, it can be concluded that we have a high percentage of female students of the UTPL Computer Science programs who are interested in entrepreneurship, who have thought about starting a business, who know people in their environment who have started their own business and it seems that the conditions for entrepreneurship would be favorable, They also expressed the need for entrepreneurship to improve their economic situation, be independent and generate employment, however, among their main limitations, unlike men, is their motivation, self-confidence and self-confidence, followed by the need for financing and training. These results are similar to other studies carried out in Latin America, since women still face cultural barriers and stereotypes.

Likewise, upon performing a detailed analysis, it can be concluded that female students in the field of computing consider financing and motivation to start their entrepreneurship as the main barriers, so we can conclude that although it is necessary to implement actions that allow female students to realize their entrepreneurial ideas, these must be adjusted to the needs of each career environment.

Regarding the employment situation, we can highlight that women who are working in their own companies are 6% more than men, however, the percentage of women whose work is not related to their current job is 26% higher than in the case of men,

It is important to consider that in recent years the need for entrepreneurship training in higher education institutions has increased, as an additional role to teaching and research, and undoubtedly they play a fundamental role in the socioeconomic transformation of cities. Currently, in several higher education institutions, entrepreneurship training is being included in the career curriculum, which allows the possibilities of starting their own businesses to be expanded.

#### 4. References

- [1] F. P. Poncio, "An investigation of the gender gap in the information technology and engineering programs through text mining," *Decision Analytics Journal*, vol. 6, p. 100158, Mar. 2023, doi: 10.1016/J.DAJOUR.2022.100158.

- [2] A. García-Holgado, S. Segarra-Morales, A. B. González-Rogado, and F. J. García-Peñalvo, "Definition and Implementation of W-STEM Mentoring Network," *CEUR Workshop Proc*, vol. 3321, pp. 32–41, 2022.
- [3] S. Idrovo Carlier, "Realidades y desafíos de los emprendimientos de mujeres en áreas STEM," *INALDE Nro 54*, Chia, pp. 17–21, Mar. 2020. Accessed: May 04, 2023. [Online]. Available: <https://www.inalde.edu.co/blog/revista-inalde-digital/realidades-y-desafios-de-los-emprendimientos-de-mujeres-en-areas-stem/>
- [4] A. Z. M. Shahriar, "Gender differences in entrepreneurial propensity: Evidence from matrilineal and patriarchal societies," *J Bus Ventur*, vol. 33, no. 6, pp. 762–779, Nov. 2018, doi: 10.1016/J.JBUSVENT.2018.04.005.
- [5] N. Di Paola, "Pathways to academic entrepreneurship: the determinants of female scholars' entrepreneurial intentions," *Journal of Technology Transfer*, vol. 46, no. 5, pp. 1417–1441, Oct. 2021, doi: 10.1007/S10961-020-09824-3.
- [6] Y. Kovaleva, S. Hyrynsalmi, A. Saltan, A. Happonen, and J. Kasurinen, "Becoming an entrepreneur: A study of factors with women from the tech sector," *Inf Softw Technol*, vol. 155, p. 107110, Mar. 2023, doi: 10.1016/J.INFSOF.2022.107110.
- [7] R. S. Shinnar, O. Giacomini, and F. Janssen, "Entrepreneurial Perceptions and Intentions: The Role of Gender and Culture," <https://doi.org/10.1111/j.1540-6520.2012.00509.x>, vol. 36, no. 3, pp. 465–493, May 2012, doi: 10.1111/J.1540-6520.2012.00509.X.
- [8] J. Byrne, S. Fattoum, and M. C. Diaz Garcia, "Role Models and Women Entrepreneurs: Entrepreneurial Superwoman Has Her Say," *Journal of Small Business Management*, vol. 57, no. 1, pp. 154–184, Jan. 2019, doi: 10.1111/JSBM.12426.
- [9] P. Szenkman and E. Lotitto, "Políticas públicas para romper con el círculo vicioso de las mujeres en STEM.," *Documento de Políticas Públicas CIPPEC*, Buenos Aires, pp. 1–34, Nov. 2020.
- [10] A. Abbasiachavari and J. Block, "Perceptual factors explaining the gender gap in entrepreneurial propensity: A replication and extension," *Journal of Business Venturing Insights*, vol. 17, Jun. 2022, doi: 10.1016/J.JBVI.2022.E00303.
- [11] H. Zhang and H. Chen, "Sustainable entrepreneurship out of entrepreneurial opportunity identification: The mediating role of psychological capital," *Front Psychol*, vol. 14, p. 1069, Mar. 2023, doi: 10.3389/FPSYG.2023.1129855/BIBTEX.