

# STEM females Ecuador, initiative, and the labor scenery

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## Abstract

This article presents an analysis of the findings from the first approach to women in science, technology, engineering, and mathematics (STEM) in Ecuador, intending to propose and promote the formation of a STEM women's community. This approach enabled Ecuador to collect first-hand information about the current labor reality of women in this relevant field. The strategy used was to (i) gather actors who are interested in promoting women's participation in STEM fields, (ii) develop a first approach to the target group, (iii) execute, (iii) collect data, and (iv) analyze the results. Among the most significant findings they discovered; the following stand out Women are very interested in becoming a part of the proposed community. Identify the labor reality of STEM women in Ecuador, which shows that 84 percent of respondents have a job, with most respondents working in academia or research. A small but interesting percentage of entrepreneurs, 14 percent, was also discovered.

## Keywords

WSTEM, Women in STEM, Ecuador, WIE

## 1. Introduction

In a global labor market increasingly driven by science, technology, and innovation (STI), it is critical to level the playing field for women in order to improve countries' competitiveness. According to data from the UNESCO Institute of Statistics (UIS), less than 30% of the world's researchers are women. The data show how many of these women work in the public, private, or academic sectors, as well as the fields in which they conduct research [1]. Some predictions, considering the current Fourth Industrial Revolution, show that future jobs will require Science, Technology, Engineering, and Mathematics (STEM) competencies; for example, the World Economic Forum predicts that up to 75 percent of jobs in this decade will be related to STEM [2].

In the global context, the ITU affirms that information and communication technologies (ICT) can contribute to accelerating the achievement of each of the 17 United Nations Sustainable Development Goals (SDGs) as a common framework for the entire world's sustainable development, particularly by promoting the inclusion of disadvantaged groups such as women and girls.

Aware of this reality, teachers from the Universidad Técnica Particular de Loja (UTPL), Universidad Técnica del Norte (UTN), and the IEEE Affinity Group Women in Engineering in Ecuador have joined forces to create a community called Women STEM Ecuador. This document describes the methodology used thus far, as well as data collected on the current situation of women in the STEM field.

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As a result of the foregoing, this document analyzes the current situation regarding women's participation in STEM disciplines and details the initiatives being developed by groups with goals related to women's involvement in STEM.

## **2. Methodology**

This section provides a synthesis of the methodology used to collect data on the current situation of women in STEM fields in Ecuador, which can be summarized in the points below.

### **2.1. Create a working group that shares a common interest.**

It began by sharing the initiatives and common interests of the actors, in this case, teachers from UTPL and UTN universities, as well as members of the Institute of Electrical and Electronic Engineers (IEEE) in Ecuador's Women in Engineering (WIE) Affinity Group. The following initiatives were identified as the most important:

#### **2.1.1. W-STEM project**

The European project "Building the Future of Latin America: Involving Women in STEM (W-STEM)" arose from the need for Latin America and the European Union to develop a joint strategy to attract young women to STEM programs through access, attraction, and democratization of higher education.

The same that receives funding from the European Union, as well as competitive funds Erasmus+, reference 598923-EPP-1-2018-1-ES-EPPKA2-CBHE-JP, execution time three years beginning in 2019, coordinated by the University of Salamanca (Spain), developed by a consortium of fifteen partner universities from the European Union and Latin America. Ecuador is represented by the Universidad Técnica Particular de Loja (Loja) and the Universidad Técnica del Norte (Ibarra). The entire group of higher education institutions contributes different experiences to develop a "joint university-level strategy for STEM programs."

This project aims to establish mechanisms and strategies that influence gender equality policies, with a particular emphasis on attracting, accessing, and guiding women to STEM careers available at Latin American universities, emphasizing Chile, Colombia, Costa Rica, Ecuador, and Mexico [3]. Although European countries are at various stages in terms of closing the gender gap in STEM, a culture of gender equality is embedded in most Latin American universities.

Since 2019, the W-STEM project has been working on various activities, two of which are described below: attraction campaigns in secondary schools in the Latin American countries involved in the project [4], as well as the creation of local nodes in member universities. WSTEM UTPL and FICA STEM UTN

##### **2.1.1.1. FICA STEM UTN**

The Universidad Técnica del Norte, aware of the need to find strategies to help women enter STEM fields (Science, Technology, Engineering, and Mathematics), has been a part of the ERASMUS W-STEM International Project since 2019. It all started with the formation of an internal group called "FICA STEM" to develop good practice, which is made up of technical women, teachers, researchers, professors from STEM programs, and members of the W-STEM project who have contributed to its implementation.

Its main actions are aimed at contributing to and promoting the involvement of both girls and young people in science, technology, engineering, and mathematics, so that they can pursue a technical career in the future. In addition to integrating, promoting visualization and participation of university teachers,

as well as the students. The group has a distinguishing feature, which is a t-shirt and a Facebook page called "FICA STEM," which allows them to have a better visual representation.

### **2.1.1.2. WSTEM UTPL Node**

The W-STEM UTPL node is made up of UTPL STEM career teachers and students, as well as educational units in the city of Loja, to carry out activities that contribute to the attraction, access, and retention of students in STEM careers.

The activities with high school students have been focused on motivating interest in STEM professions through talks and conferences, as well as facilitating experience with the profession through experimental activities in workshops and bootcamps. On the other hand, activities with teachers have concentrated on methodological strategies for teaching mathematics, physics, and chemistry using ICTs.

Furthermore, the node's activities have been expanded through an agreement with the Zonal Education District, resulting in webinars on methodologies, strategies, and tools for teaching computing in the twenty-first century, computer security, innovation, and entrepreneurship for secondary education school teachers.

### **2.1.2. IEEE WIE Affinity Group**

IEEE Women in Engineering (WIE) is a global network of IEEE members and volunteers dedicated to promoting women engineers and scientists and inspiring girls worldwide to pursue academic interests in engineering and science careers. IEEE is the world's largest technical professional organization dedicated to technological advancement for the benefit of humanity [5].

Our goal is to promote the recruitment and retention of women in technical disciplines worldwide, and we envision a vibrant community of IEEE women and men working together to innovate for the benefit of humanity.

Among our priorities as an affinity group in Ecuador is to raise awareness of the importance of women in STEM fields in Ecuador, to encourage professional and student members to actively participate in projects that allow girls and young people to participate in STEM activities, and to develop events with IEEE certified high-level technicians.

## **2.2. One step at a time, first step**

Once the previous actions of each actor had been socialized, the coincidence in purpose was identified: promote the participation of women in engineering and STEM areas.

Therefore, it is proposed as a first step to identify the current women in the STEM situation branches in Ecuador and propose the creation of a community that allows its members to share information and resources, keep in touch through virtual spaces and in due moment face-to-face, among others.

## **2.3. Instrument design and application**

The instrument to collect information, was developed among the authors of the initiative, the instrument is composed of two main elements, an introduction and nine questions, as shown below:



# Mujeres en STEM

## Mujeres en STEM (Ciencia, Tecnología, Ingeniería y Matemáticas) Ecuador

*Kind regards, dear colleague.*

*We are a group of Ecuadorian women, students and professionals in STEM branches, who want to build a community of STEM women in Ecuador, with the following initial purposes:*

*Obtain, provide and share updated information on the participation of women in STEM education and profession in Ecuador.*

*Make visible women's contribution every day to science, technology, engineering, and mathematics (STEM).*

*To form a sustainable community in order to improve access, training, participation and professionalization of Ecuadorian women in STEM branches.*

We invite you to be part of this community and ask to answer the following 9 questions:

1. What is your relationship with STEM today?
2. If you are studying or have completed your STEM studies, which of the following areas of knowledge is it most aligned? If your area is not on the list, you can add a new one in Others
3. If you have completed your studies, what is your current situation?
4. If you are working, is your current job related to what you studied?
5. If you are working, your current job is more related to which area of the company (you can select more than one option)
6. Would you like to be part of a community of women in STEM in Ecuador?
7. What benefits do you think the community should have to make it attractive to you?
8. If you are interested in being part of the STEM women community in Ecuador, share your email
9. What city do you currently live in?

The instrument was implemented using a google form [6]. This instrument was sent to women in the researchers' academic and professional networks, and it was distributed mostly through social media, email, and the IEEE email list.

## **2.4. Results**

A total of 167 responses were received, with some of the most pertinent data included in section 3 of the analysis of the findings.

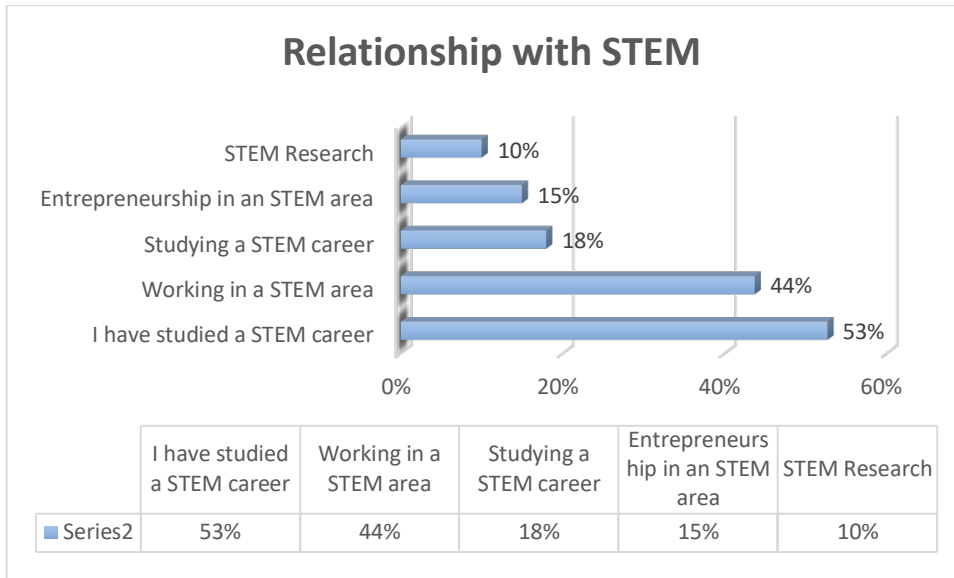
## **3. Discussion and analysis of the results**

The analysis of the results obtained with the application of the instrument for diagnosing the current situation of women in STEM branches in Ecuador is shown, for this, two types of analysis are used that are described below:

- *Quantitative*, where the most relevant results are analyzed for each question, for this purpose a graphic representation and a brief description of the results will be used mainly.
- *Comparative*, to identify the relationship between the field in which the respondents operate and the STEM disciplines.

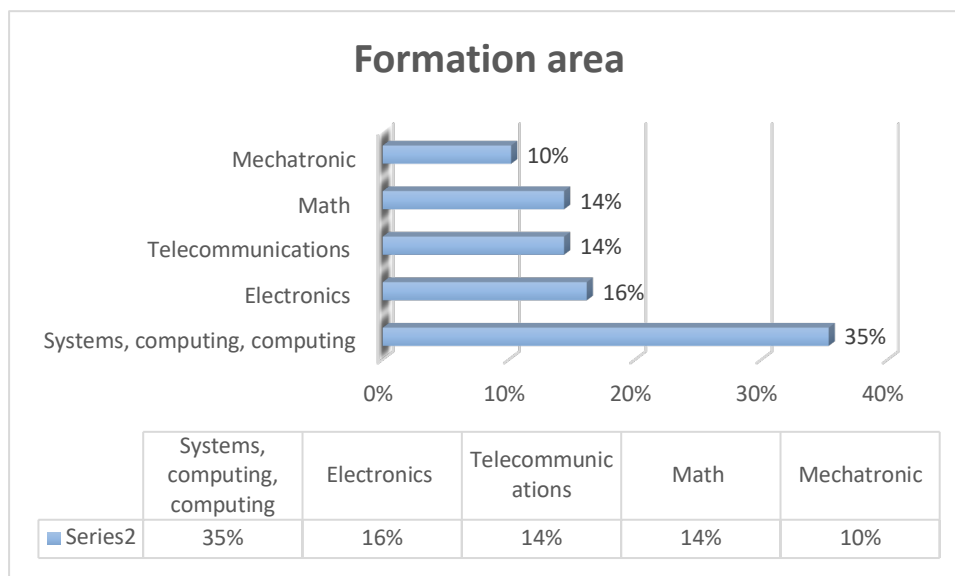
### 3.1. Quantitative analysis

The first question of the instrument is intended to identify the relationship of the respondents with the branches of science, technology, engineering and mathematics (STEM), figure 1 shows the 5 options with the highest number of responses. The results obtained highlight that more than 50% of those surveyed have studied a career related to STEM branches, while 44% are working in areas related to STEM.



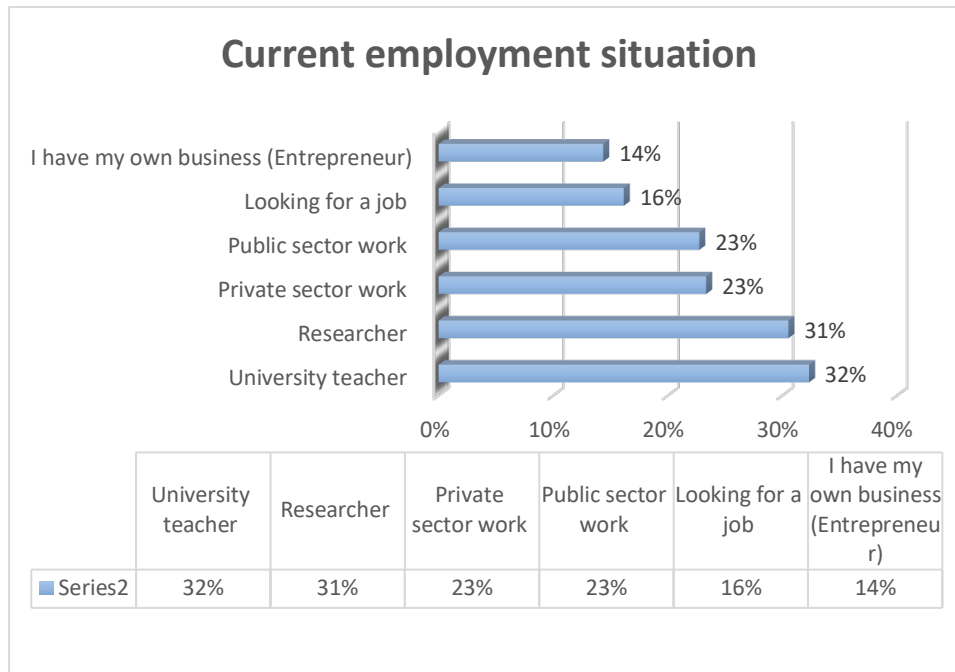
**Figure 1:** Relationship of surveyed women with STEM branches

The second question of the instrument is dependent on the answer to the first question. For those who are studying or have completed their studies in STEM, which of the following areas of knowledge is it more aligned? The 5 options with the highest number of responses are shown in Figure 2, where it can be seen that many respondents are related to computer science, followed by electronics, telecommunications, mathematics and mechatronics.



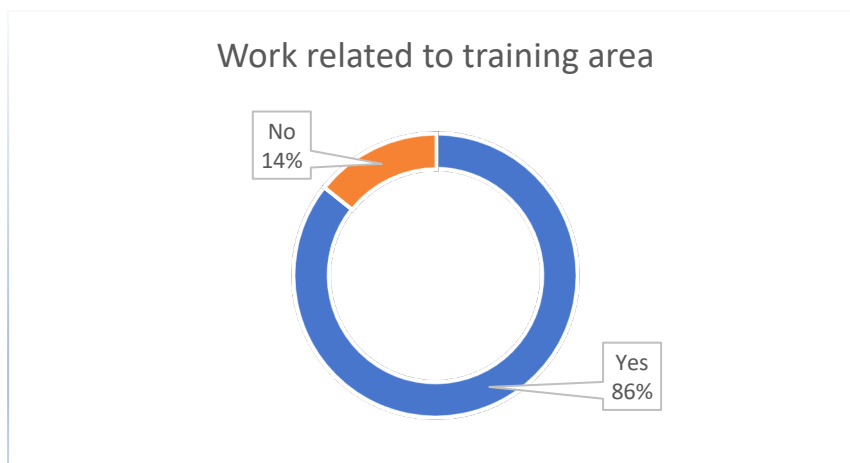
**Figure 2:** Formation area for women surveyed.

Question 3, as well as question 2, is related to the first question, it is aimed at those surveyed who have completed their studies and inquired about the current employment situation. Figure 3 shows the 6 options with the highest number of responses, including an additional answer to the previous ones, considering that the result of the last item shows an interesting fact about the percentage of women with STEM training who undertake. Another fact to highlight is that only 16% of those surveyed are looking for work, from which it can be deduced that the remaining 84% currently have a job.



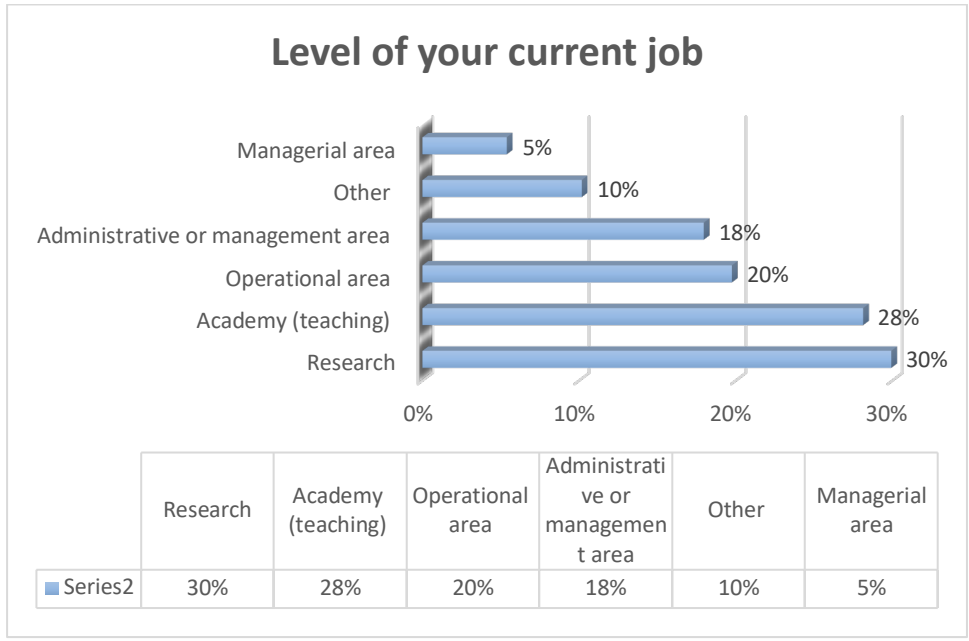
**Figure 3:** Current employment situation of the surveyed women.

Question 4 seeks to identify the relationship between the work performed by the respondents and their field of training, the following question was posed: Is your current job related to what you studied? The responses obtained are shown in figure 4 where it is observed that 86% of the respondents are working in areas related to their training field.



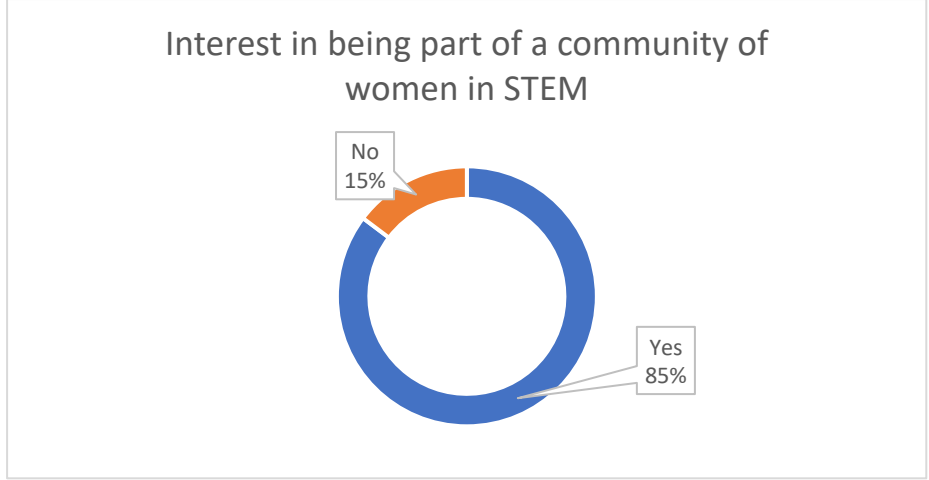
**Figure 4:** The work of the women surveyed is related to their area of training.

Question 5 is the last question related to the work environment of the respondents and aims to identify at what level of the company the respondents are working for this, the question was posed is your current job is more related to which area of the company? The results show that most respondents are in the research and teaching area, adding up to about 60%, while only 5% are in the management area, as shown in figure 5.



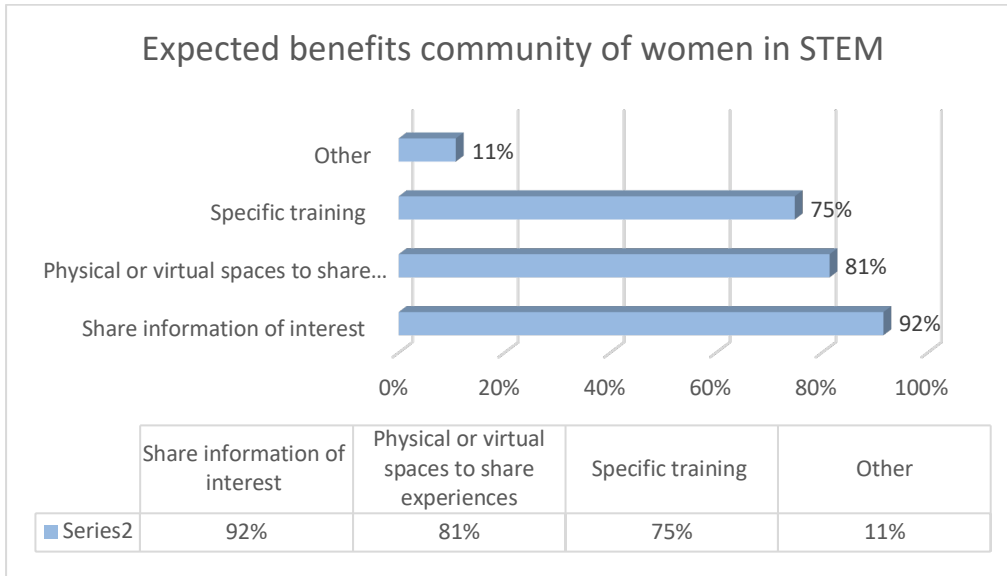
**Figure 5:** Company level where your current job is located.

Questions 6 and 7 are focused on the interest of the women in being part of a community of Women in STEM in Ecuador, question 6 promptly asks if they would be interested in being part of this community, as shown in figure 6 the results are quite encouraging since 85% of those surveyed express interest in the proposal to create the community.



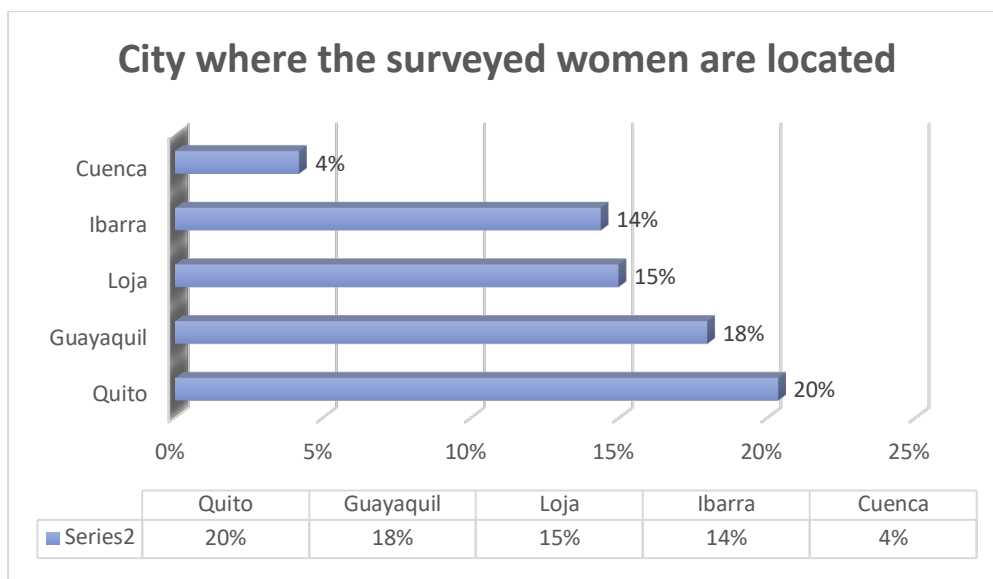
**Figure 6:** Interest of respondents in being part of a community of women in STEM

Complementary to the results of question 6, the results of question 7 list some of the benefits that community respondents would be interested in perceiving as attractive, and they are shown in Figure 7.



**Figure 7:** Benefits that you would be interested in receiving community of women in STEM

Finally, question 9 requests information about the city in which the women surveyed live; the 5 cities with the highest number of responses are shown in figure 8, and it can be seen that the cities with the highest number of responses are those to which the researchers belong, which is consistent with the sample of women surveyed.



**Figure 8:** City where the surveyed women are located.

### 3.2. Comparative analysis

Once the qualitative results have been presented, a comparative analysis is carried out between the results obtained. In addition, a comparative analysis is carried out with data at the regional level, this will allow defining if there are significant statistical differences between the national panorama and the regional panorama, which lead to correct conclusions.



### 3.2.1. A comparison of the knowledge area, work area, and current work area

In the comparative analysis shown in figure 9, it is identified that the largest number of women in STEM is in the area of knowledge of Systems, Informatics and Computing with 35%, in second place, there is Electronics with 16%, and then Telecommunications reaching 14%. In contrast to the number of women who are working in the same area of knowledge in which they studied, there is 66% who answer affirmatively and the number of women who do not work in the same area of study is 11%. Regarding the participation of the current work area, the 3 sectors in which there is the greatest participation of women are the Research area with 30%, in the academy or teaching reaching 28% and in the operational area with 18%.

#### PANORAMA OF WOMEN IN STEM ECUADOR (2020)

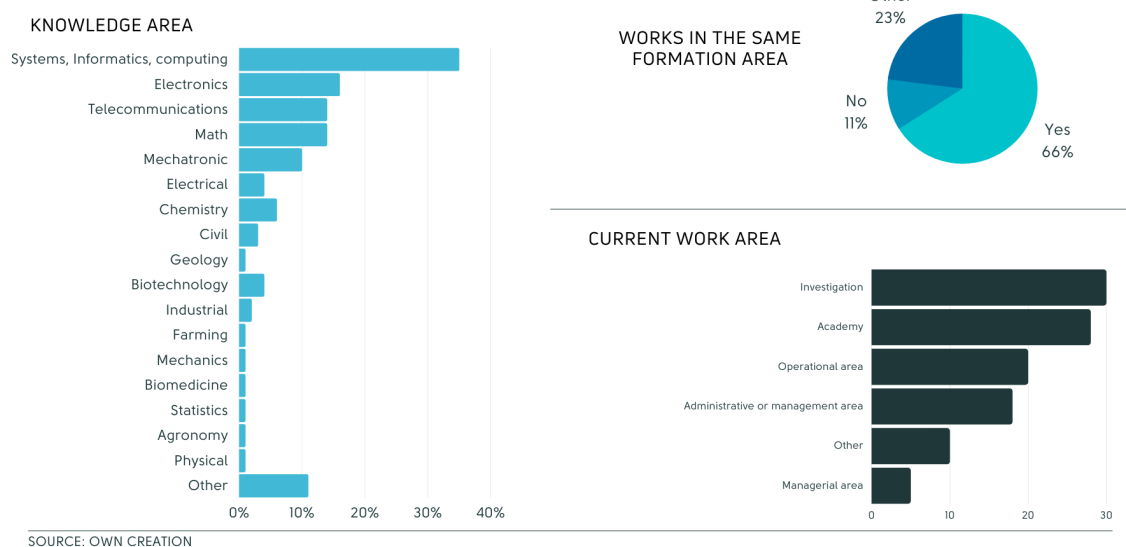
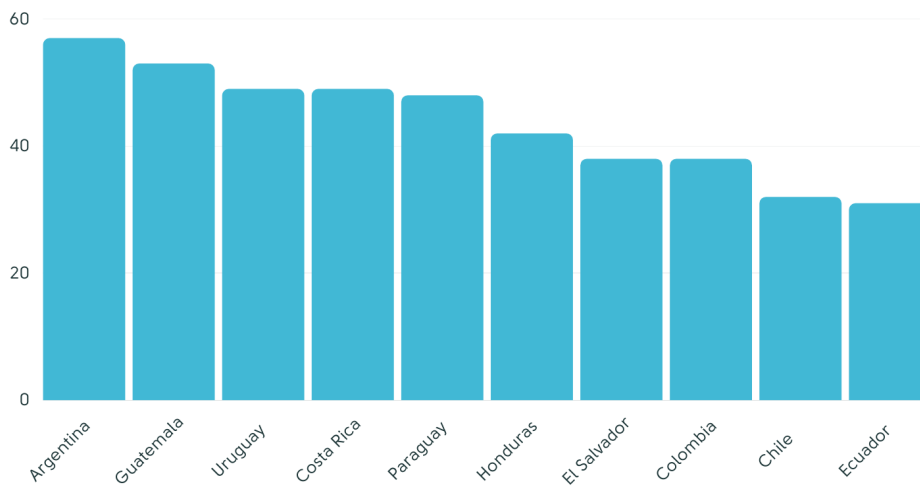


Figure 9: Comparative analysis of the panorama of women STEM Ecuador (2020).

### 3.2.2. Comparative analysis of the percentage of female researchers in higher education by country.

In Figure 10, an adaptation of the data presented in RICYT in terms of percentage of researchers in higher education in Latin American countries was made and Ecuador was added with the data obtained in the survey carried out, to carry out a comparative analysis for identifying what is the panorama of Ecuador concerning the region.

PERCENTAGE OF FEMALE RESEARCHERS IN HIGHER EDUCATION BY COUNTRY



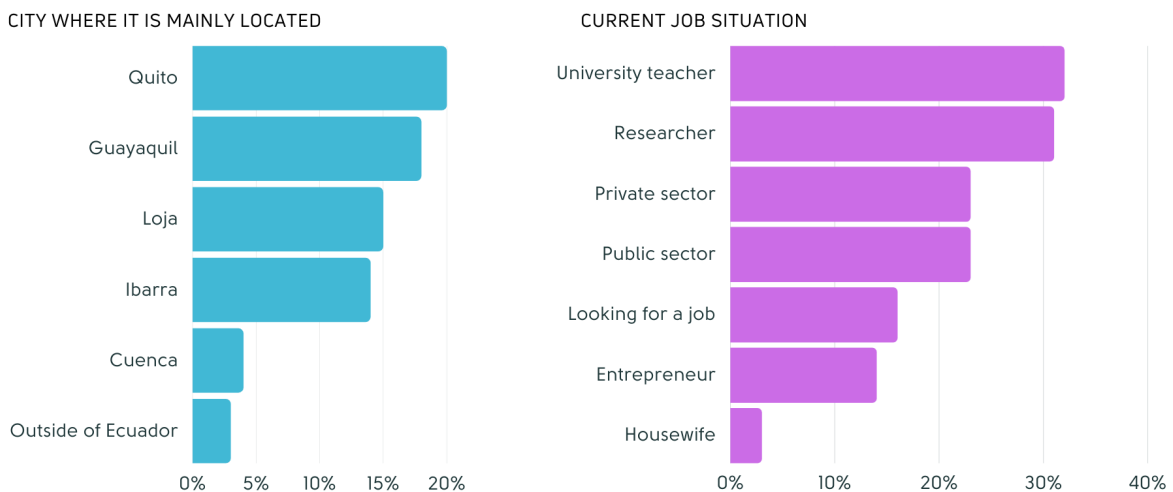
SOURCE: ADAPTATION OF ECUADOR DATA INTO RICYT SOURCE DATA

**Figure 10:** Percentage of female researchers in higher education according to Latin American countries.

In figure 10, it is identified that at the research level Ecuador has the lowest percentage concerning other Latin American countries and gender parity has not yet been reached in this area. According to the statistics presented by RICYT in 2018, the regional average of female researchers is 45%, in the surveys carried out it is only reached 31% in Ecuador.

### 3.2.3. Comparative analysis of geographic location and current employment situation

GEOGRAPHIC LOCATION AND CURRENT EMPLOYMENT SITUATION



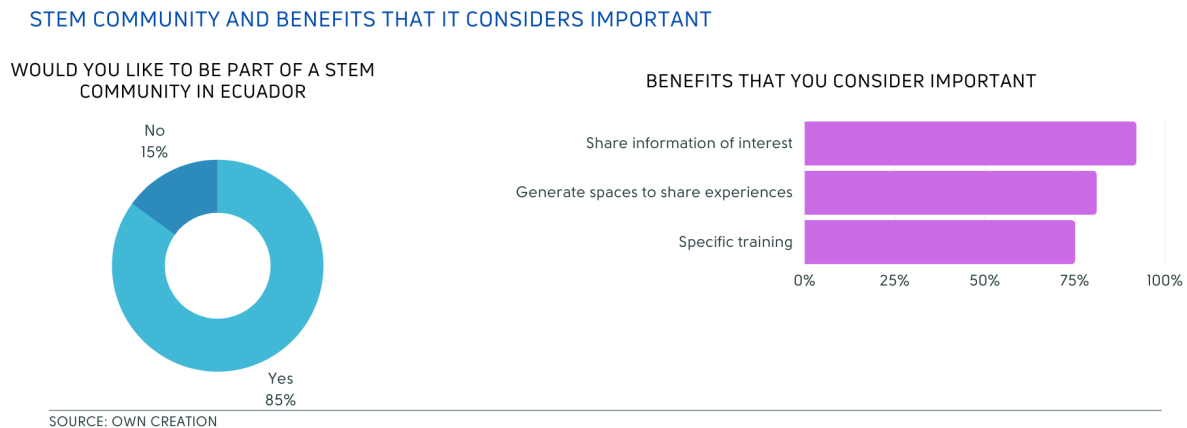
SOURCE: OWN CREATION

**Figure 11:** Geographical location and current employment situation for women in Ecuador (2020).

In figure 11, it is identified that the largest number of women is concentrated in the capital of Ecuador, Quito with 20%, with a short difference there is Guayaquil with 18%, then Loja and Ibarra

with 15% and 14% respectively. In contrast to the current employment situation, 32% work as university teachers, 31% work as researchers, and there is a balance between the percentage of women who work in the private sector and the public sector with a percentage of 23 %.

### 3.2.4. Comparative analysis of the STEM community and benefits that it considers important



**Figure 12:** Women in STEM community and benefits it considers important.

In figure 12, it is identified that there is a large percentage of women who want to belong to a STEM community in Ecuador, 85% answered affirmatively. These women give more relevance to the need to share information of interest and generate physical and virtual spaces that allow sharing experiences.

The results correlate with those carried out in other studies, among which we can mention [11] [12], some countries have a high proportion of women in science (Argentina, 52%, Bolivia, 62%), while in others like Colombia, Ecuador or Chile, this ratio is around 30%. In Mexico, 47% of science graduates are women.

## 4. Conclusions

Regarding the feasibility of creating a community of STEM women in Ecuador, the results obtained allow us to identify a high interest of women related to STEM branches in Ecuador, 85% are interested in being part of this community.

The results obtained provide us with a first basis of the current employment situation of women in STEM branches in Ecuador, it is found that 84% are currently working, and 86% are working on issues related to their training. In addition, 60% work mainly in academic and research areas, while 14% are entrepreneurs.

The percentage of female researchers in Ecuador in relation to other Latin American countries is low and gender parity has not yet been reached in this area. The regional average of female researchers is 45% and, in the surveys, carried out in Ecuador, only 31% is reached.

The research also aims to communicate essential statistical data on the realities of STEM women in Ecuador from several angles.

## 5. Future jobs

Expand the sample size of women in STEM branches in Ecuador to acquire results that are as close to reality as possible, primarily in terms of scope to other cities in Ecuador and in terms of work, to include others such as STEM women in industry and production. Create an observatory for women in STEM in Ecuador that allows for periodic gathering of relevant information, distribution of the information gathered in interest groups, training and consolidation of the community of women in

STEM, and identification and response to needs via strategic alliances. Consolidate the Ecuadorian community of women in STEM branches with members from other productive and business sectors, as the members are primarily from the education sector. Create new strategies to increase women's participation and visibility in STEM fields, as they are a fundamental to Ecuador's economic matrix.

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Our deep appreciation to the 167 women surveyed who took time out of their busy schedules to answer the questions, and many of whom wrote us messages expressing their interest in belonging to a STEM community.

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