Comparative evaluation of the entrepreneurial profile by gender in university students of business management engineering

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Abstract: Mexico has stood out in the last decade for its significant entrepreneurial activity, as the rate of creation of new small and medium-sized enterprises has increased considerably. In this context, the involvement of educational institutions is a cross-cutting issue aimed at providing a broader understanding of the various factors influencing this phenomenon. The objective of this study is to evaluate gender differences in the entrepreneurial traits of students enrolled in the Business Management Engineering program at the Instituto Tecnológico de Milpa Alta. A descriptive, observational, comparative, and cross-sectional research design was employed, utilizing the questionnaire developed by the Spanish company CIMO, which has a Cronbach's Alpha reliability index of 0.93. The study involved 45 students, and Student's t-test was used to compare mean traits and identify significant gender differences. No statistically significant differences were observed between the entrepreneurial profiles of men and women. Men achieved a mean score of 70.15 points, while women scored 64.81 points. Both groups exceeded the 60-point threshold established by CIMO as an indicator of an adequate entrepreneurial profile. The findings suggest that entrepreneurship among university students is not determined by gender but by individual, educational, and attitudinal factors. Both genders demonstrated a competent entrepreneurial profile, indicating that the entrepreneurial competencies of the program are developing effectively.

Keywords: Entrepreneurial profile, Entrepreneurship, gender, Technological higher education, University students.

1. Introduction

Developing In recent years, Mexico has highlighted the topic of entrepreneurship, given that it has a high rate of creation of small and medium-sized enterprises (SMEs). Turker and Selcuk [1] mention that professors and institutions, both private and public, have an important role in investigating and understanding the most important dimensions that influence the topic of entrepreneurship.

Schwab and Sala-i-Martin [2] points out that Mexico is considered a nation whose economy is based on efficiency. Amway [3] showed the results of the Global Entrepreneurship Report; this analysis evaluates the situation and desire for entrepreneurship worldwide. For the Mexican nation, 90% of those questioned reveal their inclination to start a personal business. Neri Guzmán [4] argues based on his study that university institutions give evidence of a shrewd robust direction in the field of entrepreneurship. In addition, entrepreneurship is emerging as an axis of growing importance for both economies and the higher education system.

The objective of this study focuses on the study of gender evaluation in the entrepreneurial profile of university students in the municipality of Milpa Alta. In order to carry out this research, the instrument of the Spanish company CIMO has been used; for which after this introduction, the

following section presents the theoretical framework and background of previous studies on the topic to be analyzed, followed by the methodology, and finally, the discussion of the results.

1.1. Problem Statement

In the current context, where entrepreneurship has positioned itself as a strategic tool for economic and social development, it is essential to identify the factors that influence the entrepreneurial disposition of individuals. In the context of the university program, growing entrepreneurs receive training due to the importance, while, in the situation of job insecurity, on the one hand, and the possibility of scientific design, on the other. And yet, a puzzling question remains: do the differences between men and women have the same entrepreneurial profile under the hypothesis under consideration?

In this sense, it is relevant to examine whether female university students present a level of entrepreneurial orientation equivalent to that of their male peers, especially in educational contexts where equity and empowerment are promoted through professional training.

Within this framework, the present study aims to analyze whether there are significant differences between the entrepreneurial profiles of male and female students of the Business Management Engineering program at the Tecnológico Nacional de México/Instituto Tecnológico de Milpa Alta (Tecnológico National Institute of Technology of Mexico/Milpa Alta Institute of Technology), using a validated instrument that allows measuring various dimensions of entrepreneurial behavior.

1.2. Study Questions

Are there marked differences between male and female Business Management Engineering students in terms of their entrepreneurial traits?

What is the degree of entrepreneurial orientation shown by university students, regardless of gender, according to the data obtained from the instrument applied?

1.3. Importance of Research

The present study becomes relevant in the academic field while it lasts, initially, its crisis of the Spanish culture, homeland and necessary. On the one hand, the collaboration between the university and civil society, in this case with governmental institutions and private enterprise, demonstrates the potential that research can have for university education as long as it is driven by the idea of both political and social inclusion. In turn, the quality of democratic education will present the possibility of access to society through entrepreneurial creation. On the one hand, the present study allows advancing in the knowledge of how this disposition is constructed in university students, while the gender analysis allows accounting for deficits or excesses, which in turn will contribute to institutional policy decisions to promote equitable opportunities in entrepreneurship. On the other hand, since the focus is on students in technological higher education, this study provides useful data for the institutions of the National Technological Institute of Mexico (TecNM) and other similar establishments with the purpose of strengthening entrepreneurial competencies on a solid diagnostic basis. Finally, the research contributes to the academic debate on the influence of gender on entrepreneurial activity in a topic of particular interest in the international literature.

1.4. Study Limitations

As a first limitation of this work is the sample size; that is, this research was conducted on 45 students, so the results cannot be generalized to other educational institutions or settings. Secondly, due to the cross-sectional nature of the present study, the information collected constituted a specific snapshot in a time frame without an evolutionary dynamic on their responses.

Another limitation lies in the fact that the instrument used, although validated, is based on the self-perception of the participants, which may introduce biases related to social desirability or lack of self-knowledge. Finally, the study does not consider other sociodemographic variables -such as

socioeconomic level, previous work experience or family context- that could influence entrepreneurial orientation.

2. Background

Muñiz Contreras [5] indicates that an entrepreneur must possess these areas, which will make him/her develop in a successful way, these are: Energy, health and emotional stability, creativity and innovation, intelligence, capacity to inspire and values. Olalde Martínez [6] argues in his study that for an institution to be successful in its students in the entrepreneurial field, it must offer an education oriented to creativity, development of managerial competencies and a proactive mentality.

Fernández Serrano [7] cites in his work sought to investigate the relationship between entrepreneurship and economic development; he jointly underlined how the emotional impulse can influence commercial progress in companies. Reyes Cervantes [8] alludes in his research that the competencies that an entrepreneur should possess are the following: management skills, legal and accounting knowledge. Tavira Sánchez [9] points out that information companies are companies created by enterprising individuals, who wish to be part of the creation and development of goods and/or services, which seek to satisfy the needs of the market not only in the country but also at an international level.

Trejo López [10] argues in his study that an entrepreneurial individual is defined as one who initiates an entrepreneurial initiative, establishes his company independently or in association with other promoters, assumes the associated financial risks, contributes with his labor and assumes the management of the company. Flores Novelo [11] cites in his research that entrepreneurial orientation is one of the important variables to achieve successful innovative entrepreneurship.

Jaime Buenrostro [12] points out in his study that the entrepreneurial development policy that has been developed in the Mexican Republic has been carried out in an efficient manner, since there is support for entrepreneurs, but there are deficiencies in the supervision and follow-up of the support that is granted.

Béjar Rodarte [13] alludes in his work that the National Entrepreneurship Fund, which shows a great effort to solve the needs of MSMEs in Mexico. Only that it is necessary to clarify a little more the objectives of this fund to be able to efficiently and effectively help Mexican entrepreneurs. Dorado Mayorga [14] mentions in his study, where he analyzed the profile of the social entrepreneur that integrate community development associations in the canton of Liberia, Costa Rica. The findings evidence the correct management of the following competencies: autonomy, rational decision-making skills, responsibility-oriented behavior, and creative and imaginative capacity, as essential elements for the development of entrepreneurial initiatives.

Hidalgo Ávila [15] points out in his research that the aspects that affect the success and failure of entrepreneurship are motivation, age, competitiveness, profitability, institutional leadership and perseverance. Moreira Menéndez, et al. [16] cite that there must be a correct synergy in the subject of entrepreneurship in a country between the private sector, state and university.

Chávez Méndez [17] alludes to his examination on the entrepreneurial dynamics and the germination of new companies in Mexican territory, giving as a result, the incremental role that women have in current times, it is also highlighted that personal fulfillment, income improvement, putting into practice what was learned in the classroom are the motivations to be an entrepreneur in Mexico. Martínez Ramírez [18] cites in his research that an acceleration program increases the value of the financial valuation of the SME, but the impact of an acceleration program in the Mexican Republic has yet to be defined, since it is not yet statistically represented by any organization. Barrera González, et al. [19] revealed that the vision of entrepreneurship among Business School students is a fervent desire to conceive companies that add value and foster a breeding ground for the foundation, structuring and strengthening of businesses. Briseño-Aguirre, et al. [20] cite that education in line with entrepreneurship should possess the fusion of the intellect of social, cultural and economic topics, which

will have an impact on increasing the possibilities of developing successful projects, which will generate value and social development.

3. Objective
To study the differences in the entrepreneurial profile between the gender of Business Management Engineering students, with the aim of analyzing similarities and divergences that contribute to the creation of training strategies for gender equality and the promotion of entrepreneurship.

4. Methodology
4.1. Method
The study was descriptive, observational, cross-sectional and comparative [21]. It is descriptive because it refers to the characteristics of the study phenomenon [22] observational given that, the description of a phenomenon within a study population allows us to know its distribution within that population [23] it is cross-sectional because the researcher performs a single measurement of the variable(s) in each individual [24] and comparative because the purpose is to elaborate a systematic comparison of cases of analysis that, for the most part, are used for the purpose of empirical generalization and corroboration of hypotheses.

4.2. Participants
In this research we will inquire about the profile of the entrepreneur in students in the municipality of Milpa Alta, it will be explained through a survey of 45 people of different ages, in order to understand how capable people are to start their own business and generate economic resources, being a very important issue today because of the pandemic that we live today being a factor that drives us to undertake.

4.3. Instrument
A questionnaire was carried out by means of Google forms, this instrument is composed of two sections, in the first one demographic data such as the person's name, age and gender were requested.

The instrument was created by the CIMO Association CIMO Association [25] which is a non-profit entity, located in Spain, with the status of a non-governmental entity, its mission is focused on the provision of services at no cost, covering a considerable diversity of services: self-employment, training, information, job placement, among others. The questionnaire is composed of 22 questions, which are answered on a Likert scale from 1 to 4, where 4 is equal to yes/fully agree and is worth 4 points, 3 is equal to quite often and has a weighting of 3 points, 2 is equal to somewhat/sometimes and has a value of 2 points and 1 is equal to no/not at all and is worth 1 point. To interpret the results yielded by the instrument, the CIMO company gives a rating scale, which is as follows:

Table 1.
Reliability statistics.

Weightings	Interpretation
Less than 30 points	In your profile, you can find elements of entrepreneurship, for the most part, you possess aspects or doubts or you are overcome by insecurity. You should analyze the reasons for all this and try to acquire entrepreneurial habits if you are serious about your own business.
From 30 to 60 points	At first glance, you have enough qualities to be good.

Source: CIMO Association [25].

4.4. Procedure
The questionnaires were administered in a personal and non-binding manner, where an invitation was sent by mail guaranteeing the privacy and anonymity of the data collected. The implementation of the questionnaire lasted 10 days. The questionnaire contained the instructions which appeared at the

top of the instrument. They were instructed in the contents of the mailing to try to be as honest as possible. The test took an average of 15 to 20 minutes.

4.5. Data Analysis

The SPSS program, specifically version 22, was used to study the data. Descriptive analyses were carried out in order to calculate the averages and proportions of the various test variables. To investigate the presence of gender differences in the variables studied, the parametric Student's t-test was performed.

4.6. Ethical considerations

The present examination was conducted under the overriding ethical guidelines that safeguard human dignity, confidentiality and data protection of the participants. All participants who took part in the study were notified in advance of the purpose of the study. They were also provided with a consent form detailing the aims of their participation, together with a guarantee of data confidentiality. The survey was conducted anonymously and did not require confidential information that could put their well-being at risk.

5. Results

The Figure 1 shows the overall summary of missing values for this study.
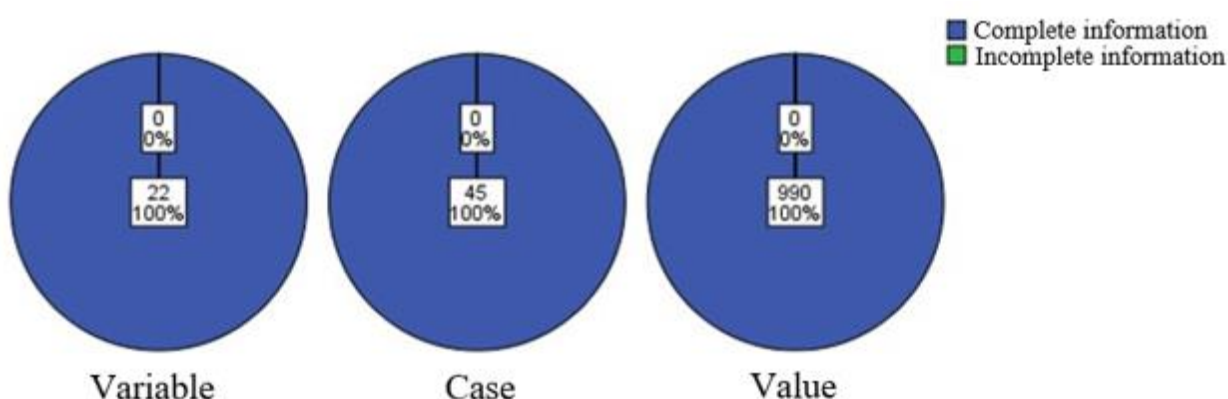
Figure 1.
General summary of missing examination values.

The above figure shows that the 22 questions were answered completely; it also shows that the 45 people who participated completed the study completely and, finally, it can be seen that 990 responses were obtained, which were analyzed in this research. In other words, as mentioned by Moreno González [26] the study was carried out successfully.

Table 1 represents the reliability study of the instrument used in the present investigation.

Table 1.
Reliability study of the instrument.

Cronbach's alpha	N of elements
0.933	22

The table above shows the result of Cronbach's Alpha parameter, which gave a result of 0.933. This result as mentioned by George [27] and Cieza Alva [28] can be taken as a very good result, since the result obtained is close to the number 1.
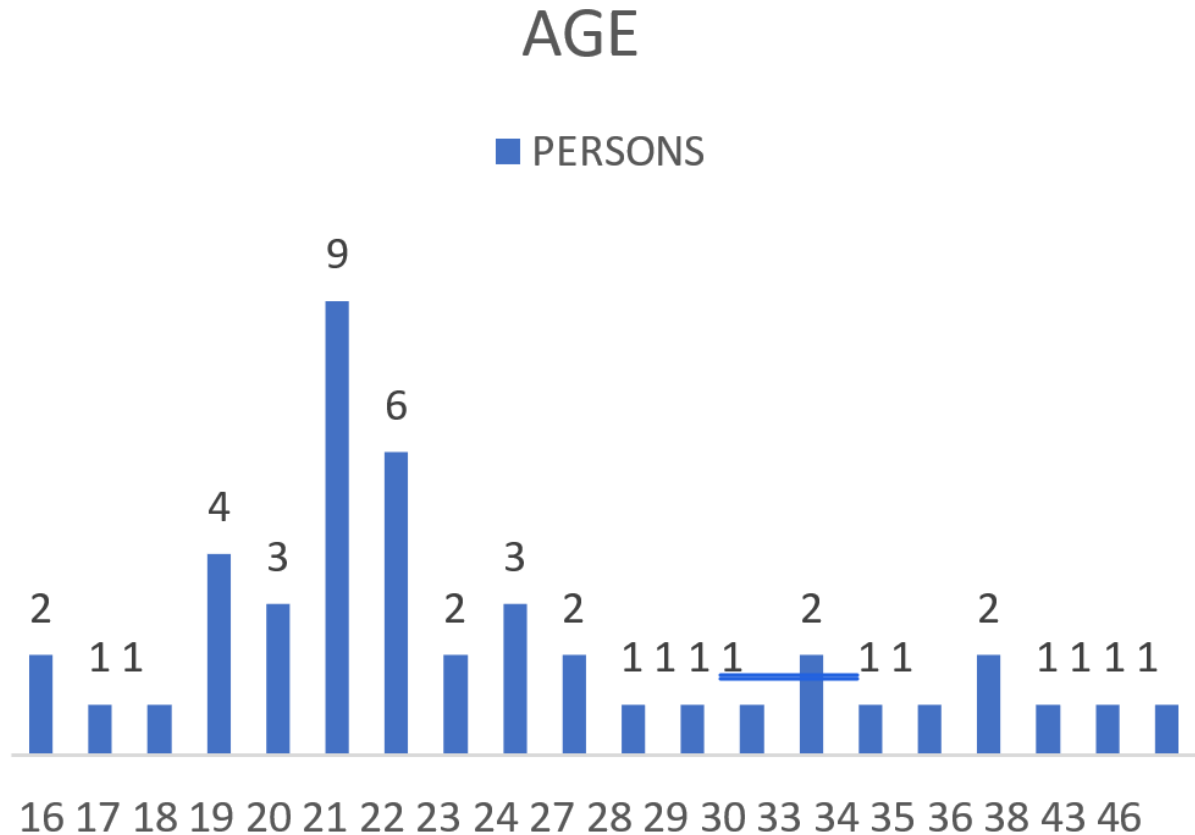
Once the responses to the instrument were validated, Figure 2 represents the results of the gender of the sample used for the present study.
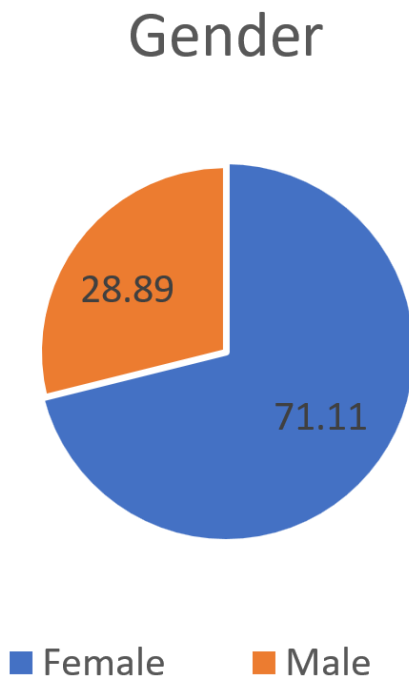
Figure 2.
Gender results.

The above Figure shows that the female gender proliferated, with 71.11%, while the male gender obtained 28.89%.

Figure 3 shows the age distribution of the sample used for this study.

AGE

Figure 3.
Age results.

The previous figure shows that the age that proliferated was 21 years old, followed by 22 years old, followed by 19 years old, and then a tie between 10 and 24 years old.

Continuing with the study and to measure the degree of normality of the men's data, the Shapiro-Wilk test was used, as mentioned by Yazici and Yolacan [29] and Sánchez [30] this test is used with a sample size of less than 30 people.

The hypothesis test, as suggested by Stephens [31] was established as follows:

$H_0:X \sim N(\mu, \sigma2)$

$H_1:X \nsim N(\mu, \sigma2)$

Table 3 shows the results of the Shapiro-Wilk test for the male sample data. SPSS statistical software version 22 was used.

Table 3.
Shapiro - Wilk statistic.

	Shapiro-Wilk		
	Statistician	**gl**	**Sig.**
VAR00001	0.920	13	0.250

The previous table shows the significant result, which is 0.250, according to Romero [32], this result is greater than 0.05, therefore, the decision taken is not to reject the null hypothesis.

Subsequently, the hypothesis test for the data of the female gender was established beforehand; in this case, the Kolmogorov-Smirnov test was used, since it is one of the most widely used techniques for

the verification of normality, as it is integrated in practically any known computer package for statistical data analysis [32]. The test was as suggested by Stephens [31] as follows:

$H_0: X \sim N(\mu, \sigma2)$

$H_1: X \nsim N(\mu, \sigma2)$

Table 4 shows the results of the Kolmogorov-Smirnov test for the female sample data. SPSS statistical software version 22 was used.

Table 4.
Kolmogorov-Smirnov[a] statistic.

	Kolmogorov-Smirnov[a]		
	Statistician	**gl**	**Sig.**
VAR00002	0.190	32	0.455

The previous table shows the significance result, which is 0.455, according to Romero Saldaña [33] this result is greater than 0.05, therefore, the decision taken is not to reject the null hypothesis.

Continuing with the study, Table 5 represents the data for each group, both male and female. Likewise, SPSS® statistical software version 22 was used to analyze the data.

Table 5.
Group statistics.

Gender	N	Media	Standard deviation	Mean standard error
Women	32	64.8125	13.02216	2.30201
Men	13	70.1538	10.47892	2.90633

Table 6.
Independent samples test.

|		Levene's test for quality of variances		t-test for equality of means						95% confidence interval confidence of the difference	
		F	Sig.	t	gl	Sig. (bilateral)	Difference in averages	Difference standard error		Lower	Upper
Tota l	Equal variances are assumed		0.476	-1.313	43	0.196	-5.34135	4.06686		-13.54295	2.86025
	No assumptions equal variances	0.518		-1.441	27.578	0.161	-5.34135	3.70756		-12.94118	2.25849

The table above shows the results of the total number of people who participated, the mean, standard deviation and mean standard error for each gender. It can be seen that the results of both genders have a certain similarity. To find out if there is similarity between both results, we will proceed to perform the independent samples test, Table 6 represents the results obtained, thanks to SPPS® software in its version 22.

The table above represents the results of the independent samples test.

We started with the Levene test of variance quality, the result was 0.476 in significance, which according to the authors Ferrer, et al. [34] if the result is greater than 0.05, it is concluded that the variances are equal.

After assuming the result where variances are equal, the t-statistic, with its bilateral significance level, provides information about the degree of compatibility between the hypothesis of equality of means and the differences between the observed population means. In the present study, the result exceeds 0.05, indicating that there is compatibility between the hypothesis of equality of population means and the differences between the observed population means. Concluding, it can be inferred that there is compatibility between the hypothesis of equality of population means. According to Díaz Pinzón [35] the treatment means are equal, hence, there are no significant differences. Dagnino [36] points out that the fact that the 0 value is included in the confidence interval limitation for the difference also suggests that it is feasible not to discard the hypothesis of equality of means.

Finally, figure 4 represents the average total score for both genders.
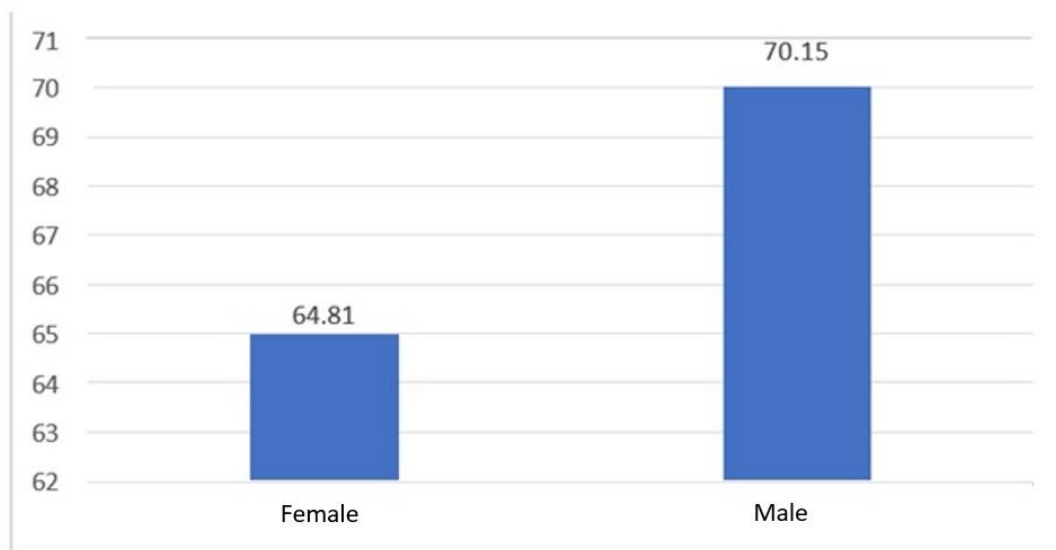
Figure 4.
Average total score.

Similar results can be seen between both genders, where the male gender has slightly higher scores than the female gender.

5. Conclusions

The findings of this research allow us to conclude that, within the specific framework of the students of the Business Management Engineering degree program at the National Technological Institute of Mexico/Technological Institute of Milpa Alta, there are no statistically significant differences between genders in terms of their entrepreneurial profile. Thus, both men and women obtain

a similar level of entrepreneurial orientation, both reaching above a threshold of 60 points on the CIMO Scale, that is, within a profile considered to be entrepreneurially oriented. Although men obtained a higher average score, the difference obtained was not significant. This reinforces the idea that entrepreneurial capacity is not determined by gender, but by certain factors carried out individually, and from a formative and attitudinal aspect can be carried out equally between men and women.

Likewise, the validity and reliability of the measurement instrument used is confirmed (Cronbach's alpha = 0.933), which gives methodological soundness to the results presented. In addition, an adequate age representation within the sample is observed, which adds richness to the analysis and allows a glimpse of the entrepreneurial potential of young people in a post-pandemic environment that demands resilience, innovation and self-management.

6. Discussion

The study of gender in the entrepreneurial profile applied to university students shows important results when studied according to gender and using the individual entrepreneur as the central element of the analysis. The career in Business Management Engineering includes among its graduation competencies the ability to venture into the field of entrepreneurship and this research shows that students in the last semesters of engineering meet on average both women and men a competitive entrepreneurial profile.

The surveyed students do not present significant differences in their entrepreneurial profile by gender. However, the study presents a slightly higher score in favor of the male gender. These results are like those reported by Díaz Pinzón [35] where men with serious intentions of creating a business show higher scores than women.

Another result to highlight is that the National Institute of Statistics and Geography [37] points out that in Mexico there is more participation in entrepreneurship by the male gender than by the female gender, a result that is like that of this study, where significantly, men had a slightly higher result than women. Finally, the degree of women's participation has been increasing and their participation as entrepreneurs has

In Mexico, the result of the female gender is remarkable in this research and is similar to what was presented in the Amway study [3].

7. Contributions to Future Lines of Research

Future research is also possible in the mirror of the present study. First, it would be necessary to expand the sample and repeat the study in various areas of higher education. In addition, it is proposed that the researchers collect data at the national level in various Russian regions. Second, the researchers find other factors that are likely to affect entrepreneurial orientation appropriate. These may be family background, socioeconomic status, and access to entrepreneurship and previous work. These variables could help identify more complex patterns in the formation of entrepreneurial attitudes.

Another recommendable line of research would be to carry out longitudinal studies that allow us to observe the evolution of the entrepreneurial profile of students throughout their academic and professional careers. This would help to determine whether the entrepreneurial orientation is maintained, increased or transformed over time and in different economic contexts.

Transparency:
The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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