

## **Working impact in the Puebla-Tlaxcala region of graduates of Mechatronics Engineering**

### **Impacto laboral en la región Puebla-Tlaxcala, de los egresados de Ingeniería Mecatrónica**

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#### **Abstract**

This work shows an analysis of the impact on the productive sector that graduates of the academic program of mechatronics engineering have had in the period 2017-2020. Said analysis was carried out to determine the competencies that should be re-considered or re-considered. -propose to improve the profile of graduation at the higher level of the mechatronics career and try to satisfy the demand of the business sector in the region. The analysis was carried out through surveys that were applied to companies in the Puebla-Tlaxcala region, and to graduates of the 2017-2020 generations, in this way, more elements were obtained for the analysis of the graduation profile, as well as make proposals for adjustments to the curriculum map. The work was carried out with the intention of having basic statistical information of state representation on the impact and occupational characteristics of the graduates of the Mechatronics Engineering Career, in the same way this information will allow to deepen on the analysis of occupational characteristics and generate proposals of continuing education with companies in the region, as well as with graduates.

#### **Resumen**

En el presente trabajo se muestra un análisis del impacto en el sector productivo que han tenido los egresados del programa académico de ingeniería mecatrónica en el periodo 2017 - 2020. Dicho análisis se llevó a cabo para determinar las competencias que se deben re-considerar o re-plantear para mejorar el perfil de egreso a nivel superior de la carrera de mecatrónica y tratar de satisfacer la demanda del sector empresarial de la región. El análisis se llevó a cabo por medio de encuestas que se aplicaron a las empresas de la región Puebla-Tlaxcala, y a los egresados de las generaciones 2017-2020, de esta manera se obtuvieron mayores elementos para el análisis del perfil de egreso, así como realizar propuestas de ajustes al mapa curricular. El trabajo se realizó con la intención de contar con información estadística básica de representación estatal sobre el impacto y las características ocupacionales de los egresados de la Carrera de Ingeniería Mecatrónica, de igual manera esta información permitirá profundizar sobre el análisis de las características ocupacionales y generar propuestas de educación continua con las empresas de la región, así como con los egresados.

**Labor, Mechatronics, Puebla-Tlaxcala Region**

**Laboral, Mecatrónica, Región Puebla-Tlaxcala**

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## Introduction

The labor market seeks to insert human resources interested in working in the labor spaces generated by companies and/or productive establishments (labor demand). Thus, supply, demand and demand factors intervene in this market according to the needs of the employer sector. These dynamics can encourage or limit the mobility of human resources that are being generated in higher education institutions.

On the supply side, there are some demographic and geographic factors that can determine the magnitude, growth and dynamism of the population. Likewise, with the competency-based approach promoted at the Polytechnic University, the Mechatronics Engineering program is completed in 3 years and 4 months; therefore, the age of graduates influences economic and cultural factors, as well as the rates of male and female labor participation.

As a result, there is a certain growth in the economically active population (EAP), translated into the number of people who are employed and/or seeking to join the labor force through job searches. According to data from the national context in which the labor market operates in Mexico, (which is carried out according to a regionalization), ten socioeconomic regions stand out within this identification and the one we will focus on in this work is the central region of the country, which involves seven states: Mexico City, Hidalgo, State of Mexico, Morelos, Queretaro, Puebla and Tlaxcala, particularly, within this region, we have a sub-regionalization in which the Puebla-Tlaxcala region is located.



**Figure 1** States that make up the central region of Mexico

Source: Prepared by the authors

In accordance with the regionalization, some aspects of the labor market in the Puebla-Tlaxcala region are examined in greater depth due to their impact and dynamism in labor supply and demand; the geographic nature and the characteristics of its migratory labor flows.

According to data from the Labor Observatory of Mexico 2020, an agency of the National Employment Service, Electronics, Automation and related engineering careers such as Mechatronics are in 7th place out of a total of 14 in the area of engineering, i.e. it is well positioned in relation to other areas of the same engineering.

Location	Degree	Men (%)	Women (%)
1	Computer Science	64.8	35.2
2	Construction and Civil Engineering	93.3	6.7
3	Electricity and power generation	92.5	7.5
4	Feeding	47.8	52.2
5	Vehicle, ship and aircraft engineering	98.9	1.1
6	Electronics and automation	92.3	7.7
7	Mechanical, Mechatronics and Industrial Engineering	78.3	21.7
8	Metallurgy	90.5	9.5
9	Chemistry	61.2	38.8
10	Manufacturing and processes	78.5	21.5
11	Mining and quarrying	90.7	9.3
12	Farming and cattle raising	88.3	11.7
13	Technology and environment	54.6	45.4
14	Information and Communication Technologies	77.5	22.5

**Table 1** Statistics of Professional Careers by area

Source: Prepared by the authors with data from the labor observatory

Some indicators of the good performance of engineering careers and the degree of efficiency of their graduates are related to: a) the flexibility of employment rates of graduates, b) salary flexibility and sectoral and regional employment opportunities, c) the relationship between salaries and the diversity of opportunities in the labor markets, and d) the level of education and training that human capital receives in universities.

Currently, schooling, understood as the number of years of formal education, has a direct and almost generalized effect on the regions in order to be able to participate in the EAP (see Figure 2).

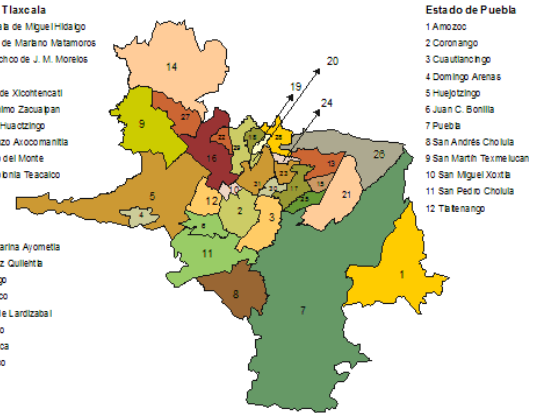


**Figure 2** Secondary sector employment rate, 4th quarter  
Source: INEGI (2020) National Occupation and Employment Survey

**Methodology**

The research methodology applied was to obtain statistical information on the characteristics of occupation and employment of Mechatronics Engineering graduates in the Puebla-Tlaxcala region through surveys, as well as information on the skills that the employer sector in this region is demanding, in order to analyze the labor impact that the generations of Mechatronics Engineering graduates of the UPTx have had in recent years.

The Puebla-Tlaxcala region (see figure 3) was chosen because of its geographical proximity to the urban dynamism and the demand in terms of employment, in addition to the fact that the predominance of industrialization over the rest of the productive activities generates that the graduates of Mechatronics Engineering find a niche of labor spaces to enter the labor field.



**Figure 3** Puebla-Tlaxcala Region  
Source: Land Use Planning Program 2005

The information obtained through surveys was directed to some companies that are within the territory that make up the region and to the graduates of the 2017 to 2020 generations.

To determine how many companies and graduates the survey would be applied to, a sample was chosen, using formula 1, which is the maximum variance statistic (Gómez, 1979), with a reliability of 95% (0.05) and a precision of 86%.

$$n = \frac{NZ^2pq}{(N-1)e^2 + Z^2pq} \tag{1}$$

Where:

n=sample size

N= total population size

Z= reliability with an  $\alpha= 1.96$

$p*q=$  because the probability of the event is unknown, 50% is assigned to the probability of occurrence ( $p$ ) and 50% to the probability of non-occurrence ( $q$ ),

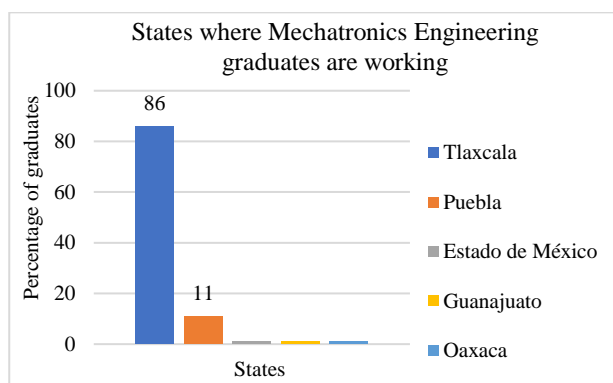
According to the formula, a sample size was obtained as shown in the following table.

Employer sector	Sample size
Companies in the Puebla-Tlaxcala region	67
Graduates	Sample size
Generations 2017-2020	107

**Table 2** Sample size determination  
Source: Prepared by the authors with data from the Department of Graduates and the Secretariat of Economic Development

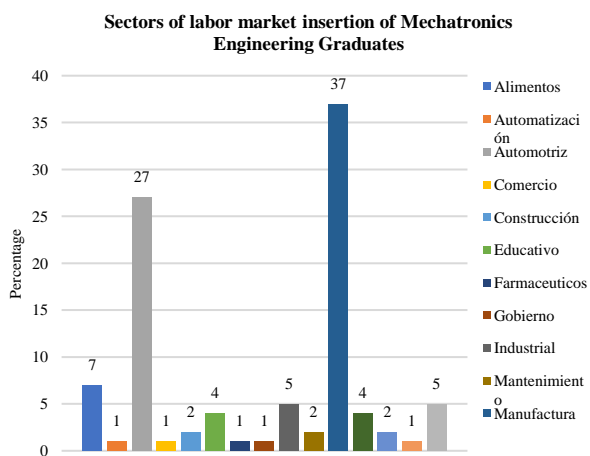
**Results**

According to the results obtained, we observe that the regional and urban development of the Puebla-Tlaxcala region has been guided by the transformations of the Puebla economy, since its changes in the productive adjustment of industry towards the machinery and equipment sector, mainly the automotive branch, have allowed the expansion of the activities of other small companies that can absorb the University's labor force.



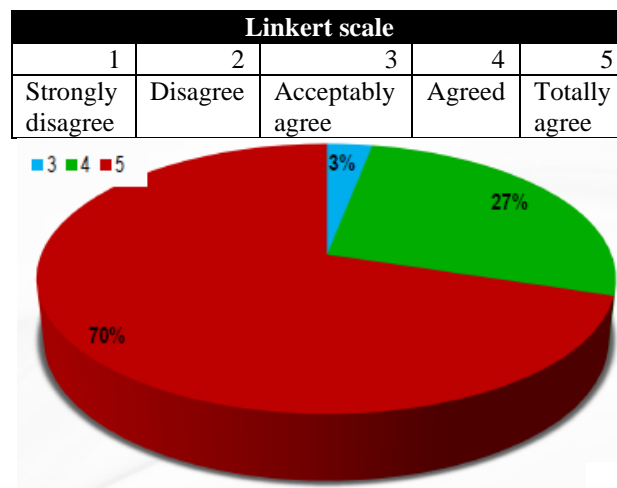
**Graphic 1** Knowledge and skills for which Mechatronics Engineering graduates were hired  
 Source: Prepared with data from the surveys

Similarly, the results show that the traditional sectors, textile, food and chemical products also expanded their activities and these presented comparative advantages that attracted the attention of the graduates and they sought to be inserted in these companies that are located in the municipalities that make up the Puebla-Tlaxcala region.



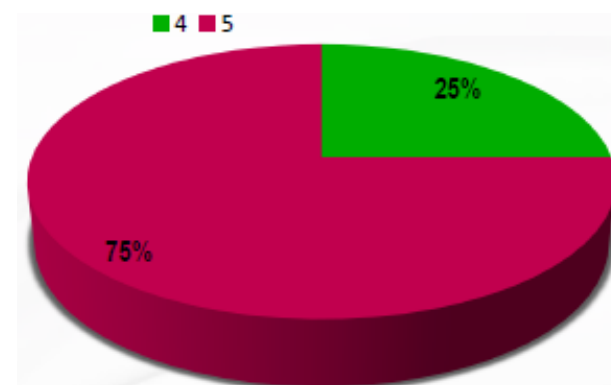
**Graphic 2** Sectors of employability of Mechatronics Engineering graduates  
 Source: prepared with data from the surveys

According to the results obtained from the employer sector, we observe that the degree of satisfaction with the technical, skills and behavioral training of the graduates of the Mechatronics Engineering Career of the UPTx, have evaluated with a linkert scale, as totally in agreement with the knowledge and skills demonstrated in their work activity.



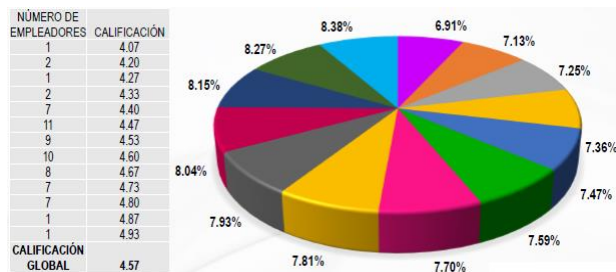
**Graphic 3** Mechatronics Engineering graduates demonstrate the knowledge and skills for which they were hired  
 Source: Prepared with data from the Department of Graduates

In the same survey, it is highlighted that employers in the Puebla-Tlaxcala region emphasize the training of Mechatronics Engineering graduates, even over graduates from other universities in the State of Puebla, who have had similar educational programs for a longer period of time.



**Graphic 4** The training of Mechatronics Engineering graduates is better in comparison with other universities  
 Source: Prepared with data from the Department of Graduates

Finally, in an overall rating of employers (companies that are geographically located in the municipalities that make up the Puebla-Tlaxcala metropolitan region) to the graduates of Mechatronics Engineering of the UPTx, has been high and they are satisfied with the skills demonstrated and the requirements that they request for the positions offered.



**Graphic 5** Overall rating of Mechatronics Engineering graduates

Source: prepared with data from the Department of Graduates

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## Conclusions

The results obtained show that the work approach of competency-based education, as well as the linkage of the employer sector with the students, from the stage of internships and stays in the industry has resulted in a positive impact on the generation of work spaces in the companies that make up the Puebla-Tlaxcala region and in which the labor force of the graduates has been demanded, due to the generic and professional competencies demonstrated, as well as their skills and abilities.

The geographic area where the University is located has had a positive impact on the graduates and has had an effect on the choice of the place of work, which as a consequence affects the labor market in the Puebla-Tlaxcala region, both in the case of men and women.

The generalized result in the region also allowed us to observe that the age of the graduates seems to be a determining factor in the decisions of the business sector to choose UPTx graduates and allow them to participate in the labor market (since the training period for engineers is only 3 years and 4 months).

The Puebla-Tlaxcala region has benefited in the labor sector with the graduates of the Mechatronics Engineering career, since the growing demand of the manufacturing industry, especially the automotive industry has grown significantly in recent years and the fact that the Polytechnic University of Tlaxcala is training competent and trained professionals according to the demand of employers allows labor insertion efficiently.

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