

**Labor market of the agroindustrial engineer of the BUAP and professional competences of the TSU in food processes of the UTP****Mercado de trabajo del ingeniero agroindustrial de la BUAP y competencias profesionales del TSU en procesos alimentarios de la UTP**

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**Abstract**

In this study an analysis of the requirements and expectations of the labor sector, the area of influence of the Autonomous University of Puebla (BUAP) and the Technological University of Puebla (UTP) is carried out in relation to the relevance of studies and the labor market for the agro-engineer and profesionista Superior Technical University (TSU) in food processes, respectively. For the collection of information and data of TSU, it was held in August 2014 a workshop on the UTP, in which the data collection methodology was followed for the development of curricula based on competences, adapted in 1992 by the Ministry of Education of Quebec (Ocampo, 2012). The methodology used in the workshop called "IXE Method", which has the mission to obtain the maximum information by consensus and thus to detect cognitive skills, psychomotor and affective partner necessary to establish a productive function under performance standards. This analysis allowed feedback training programs on learning objectives, a detailed and precise manner, achieving satisfying the demands of the labor market (Manjarrez, 2013).

**Agribusiness education, Labor market, Professional skills****Resumen**

En el presente estudio se realiza un análisis de los requerimientos y expectativas del sector laboral, de la zona de influencia de la Benemérita Universidad Autónoma de Puebla (BUAP) y la Universidad Tecnológica de Puebla (UTP), en relación con la pertinencia de estudios y el mercado laboral para el ingeniero agroindustrial y el profesionista Técnico Superior Universitario (TSU) en procesos alimentarios respectivamente. Para el acopio de información y datos del TSU, se realizó en el mes de agosto del 2014 un taller en la UTP, en el que se siguió la metodología de recolección de información para la elaboración de planes de estudio basados en competencias, adaptada en 1992 por el Ministerio de Educación de Quebec (Ocampo, 2012). La metodología utilizada para el desarrollo del taller se conoce como "Método IXE", el cual tiene como misión obtener el máximo de información por consenso y así poder detectar las habilidades cognoscitivas, psicomotoras y socio afectivas necesarias para ejercer una función productiva bajo estándares de desempeño. Este análisis permitió retroalimentar los programas de formación sobre objetivos de aprendizaje, de una manera detallada y precisa, logrando ejecuciones satisfactorias de las demandas del mercado laboral (Manjarrez, 2013).

**Educación agroindustrial, mercado de trabajo, competencias profesionales**

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## Introduction

The Agro-industrial Engineer is a human resource with knowledge and skills to manage production systems, as well as process the industrialization of food products through new technologies for the benefit of production units. Of course, it is intended that the territorial ordering and placement of graduates impact the needs of the region and its industrialization (Bernal, et. Al. 2010). In this context of engineering training, key tasks are identified for their training with the information collection methodology, for the development of competency-based study plans (Ocampo, 2012), and their general purpose is written as follows: Manage the resources and food processes of the company based on the established standards and norms, in order to achieve their optimization, as well as the design and development of new products and / or food processes and in this way satisfy the requirements of the customers. In this way, future engineers participate in the process of recruiting graduates of the upper secondary level, where BUAP is the institution that occupies the first place in coverage among public institutions, thus contributing with an absorption rate on average of 5% and 10.5% with respect to graduates from their area of influence and the State, respectively. Basically, the potential is concentrated, and they comprise 45 municipalities, where 687 institutions are located with 24,320 graduates of which; 20 thousand 998 correspond to the general high schools, 2 thousand 536 to the technological high schools, and 786 of the Technical Professional Education Colleges (CONALEP), all of them are considered as potential demand, for 240 Higher Education Institutions and 31 Normal in the State (SEP, 2015).

At BUAP, students who manage to obtain a final average of 8.5 or more throughout their studies, receive the title automatically, without the need to present a final exam or write a thesis, and additionally, several faculties introduced additional forms, such as the preparation of a thesis, or internal and external final exams, such as the General Bachelor Exit Exam (EGEL) from CENEVAL; As a result, there are now a variety of options for titration, as reflected in the table below:

Titration forms	Women (%)	Men (%)
Thesis	27.4	33.8
Thesis	1.8	3.2
Average	48.9	33.8
Other	4.4	3.1
I do not answer	17.5	26.1
Total	100	100

**Table 1** Qualification of graduates from BUAP

On the other hand, insertion into the labor market, according to the survey data, is a gradual process that begins before finishing their studies, thus, 38.8% of graduates were already working during the last year of studies (Ibid).

If you worked during your last year of studies	38.8%
You did not work during your last year of	61.3%
Did not answer	0.07%
Total	100%

**Table 2** Percentage of students who worked in their last year of studies (Ibid)

Although there is evidence of a rapid insertion into the labor market for a significant part of the students, it should also be noted that this insertion complicates the degree process, since it is difficult to combine almost thirty hours of work outside the university with the completion of subjects and the preparation of a thesis.

## State reference framework

The State of Puebla has a geographic location to the north 20 ° 50 ', to the south 17 ° 52' of north latitude, to the east 96 ° 43 ', to the west 99 ° 04' of longitude west. Puebla borders to the north with the states of Hidalgo and Veracruz-Llave, to the east with Veracruz-Llave and Oaxaca, to the south with Oaxaca and Guerrero, to the west with Guerrero, Morelos, Mexico, Tlaxcala and Hidalgo. It has an area of 33,902 square kilometers, equivalent to 1.7% of the country's total (INEGI, 2015). The State of Puebla has seven socioeconomic regions configured with four regions of urban predominance (Angelópolis, Tehuacán and Sierra Negra, Valle de Serdán and Valle de Atlixco-Matamoros), and three regions of rural predominance (Sierra Nororiental, Sierra Norte and Mixteca).

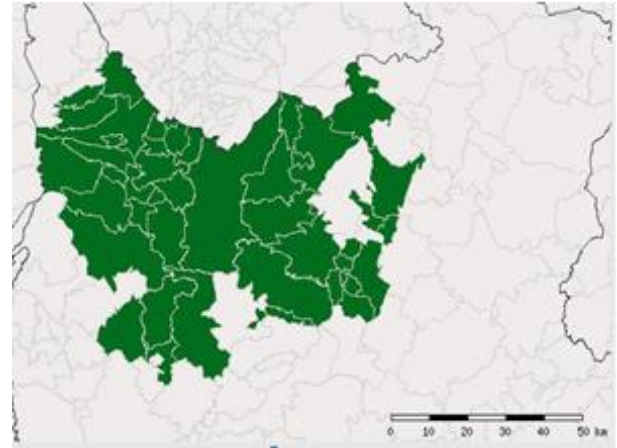


**Figure 1** Socioeconomic regions of the state of Puebla

The total population in the State of Puebla is 5 million 779 thousand 829 inhabitants, 52% are female and 48% male, 2 million 578 thousand 612 inhabitants are concentrated in the area of influence of BUAP and the Technological University of Puebla (UTP).

474,429 are in an age range between 20 and 24 years old, 27.9% study higher education in this area, 6.3% do so in other municipalities and 65.8% are not enrolled, which means a potential for young people who require support to continue their studies (ibid).

One of the opportunities for the Benemérita Universidad Autónoma de Puebla (BUAP) and the Universidad Tecnológica de Puebla (UTP), is their geographical location, a factor that has influenced their consolidation and development respectively; by counting in the state with 1 thousand 465 Baccalaureate and 158 schools of Technical Professional (in the 2013-2014 school year) of which 50 thousand 748 students graduated in the State (SEP, planning department).



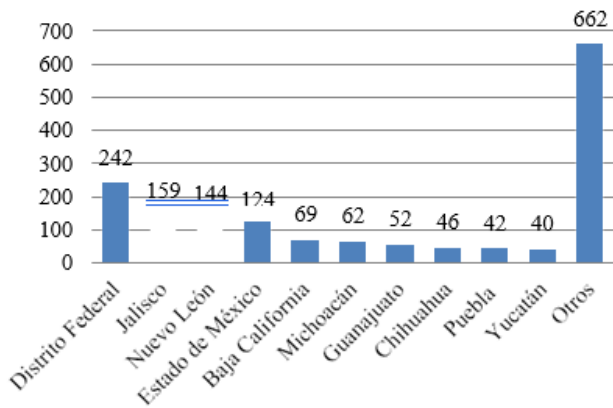
**Figure 2** Influence area identifying municipalities for BUAP and UTP

In the area of influence of both Universities there are 45 municipalities, where 687 institutions are concentrated with 24,320 graduates, 20,998 correspond to general high schools, 2 thousand 536 to technological high schools, and 786 of the Technical Professional Education Colleges (CONALEP), which are considered as potential demand, for 240 Higher Education Institutions and 31 Normal in the State.

Being the UTP the institution that ranks second in coverage after the Benemérita Universidad Autónoma de Puebla (BUAP) among public institutions; thus contributing with an average absorption rate of 10.5% and 5% with respect to graduates from their area of influence and from the State, respectively. Regarding the productive sector, in the State of Puebla there are a total of 2,140 companies distributed as follows: 125 correspond to large companies, 386 to medium and 1,629 to small ones. Of these, 38.1% correspond to the industrial branch, 39.7% correspond to commerce and 22.2% to services (ibid).

Processed foods: Puebla, among the largest producers

According to information from ProMéxico, most of the large exporting companies dedicated to food processing, the state of Puebla is among the entities of the country with the largest number of food processing and exporting companies, with a total of 42 The entity is located below the Federal District which has 242 companies; Jalisco with 159, Nuevo León with 144, State of Mexico with 124, Baja California with 69, Michoacán with 62, Guanajuato with 52 and Chihuahua with 46; the list is completed by Yucatan with 40.



Graphic 1 Main economic units states

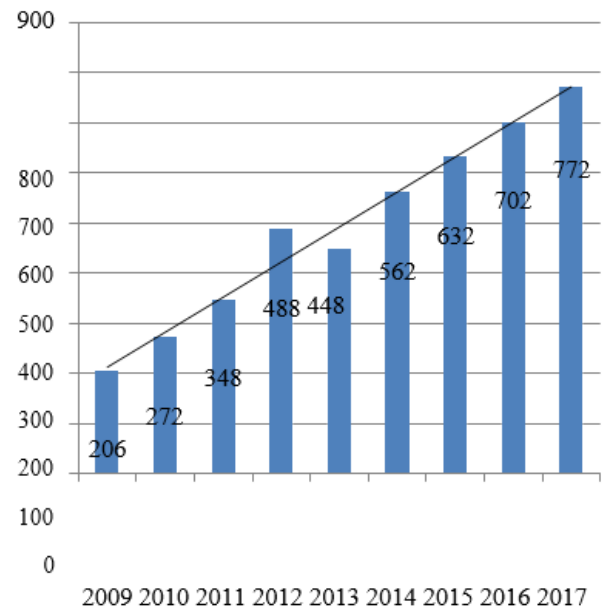
As has been pointed out, Puebla is one of the entities with the largest economic units in the processed food sector, with 13,494; it is located only below the State of Mexico, which has 21,386; According to figures from the Ministry of Economy, in 2012 the Foreign Direct Investment (FDI) of the industry in Mexico was concentrated in Nuevo León, Jalisco, Edomex and the DF, hence the food processing industry is one of the sectors key in the country's economy (Secretary of Economy, 2015).

In Mexico, according to the secretary of economy, the production of processed food in 2012 was 123 thousand 954 million dollars, which represented an increase of 2.3% compared to 2011. The food industry represents 23.2% of the manufacturing GDP and 4.1% of the Total GDP. Thus, Mexico is the second largest food supplier to the United States and the third largest producer of processed foods in Latin America; and worldwide, it ranks eighth. In 2012, the main export destinations were the United States, Japan, and Guatemala, with a share of 68.5%, 6.3%, and 2.4% in the total Mexican exports of the industry, respectively. (<http://mim.promexico.gob.mx/work/sites/mim/resources/LocalCo999>) ntent / 72/2 / Alimentos\_pr ocesados\_ES.pdf).

**Present and future demand for skilled labor**

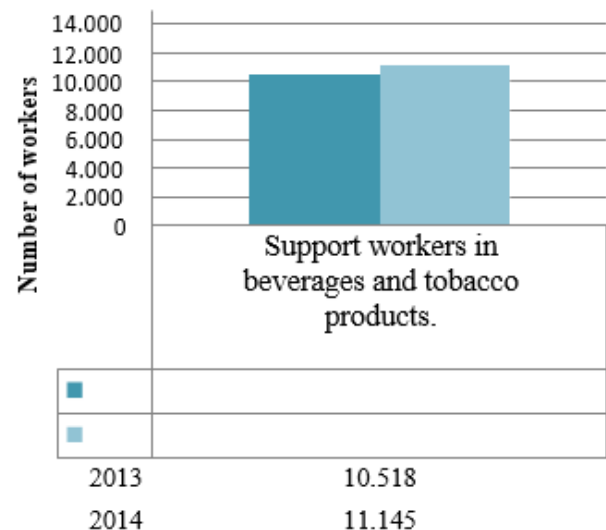
The economically active population of the state represents 60.24% of the total population aged 14 and over, and the inactive population 39.76%, according to the third quarter of 2014 (SEDECO, 2015). According to information from ProMéxico, most of the companies dedicated to food processing in Puebla are dedicated to food preparations and sauces.

Puebla is among the entities of the country with the largest number of food exporting processing companies, with a total of 42. The entity is located below the Federal District which has León with 144, State of Mexico with 124, Baja California with 69, Michoacán with 62, Guanajuato with 52 and Chihuahua with 46; the list is completed by Yucatán with 40 (ibid).



Graphic 2 UUTT enrollment projection

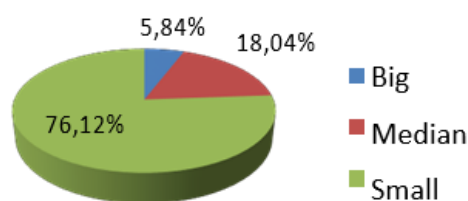
Regarding the projection of total enrollment of the Educational Program of TSU in Food Processes of all the UUTT of Puebla. The projection was based on the historical information provided by the UTT Puebla, Tecamachalco UT, Izúcar de Matamoros UT, Xicotepc de Juárez UT and Tehuacán UT. The following graph presents for the state of Puebla, the total number of people working in this occupation during the period 2013-2014.



Graphic 3 Annualized figures as of the fourth quarter

The growth in the number of support workers in the food, beverage and tobacco products industry in 2014 was only 5.96% compared to 2013; and the economically active population represents 60.24% of the total population aged 14 and over, and the inactive population 39.76%, according to the third quarter of 2014. The participation rate of the employed population is 58.0% of the total population of 14 and over. And to strengthen the University-Company link with mutual collaboration actions, the UTP offers services such as: studies and technological services, updating courses, training, professional development, and continuing education courses aimed at University graduates and workers from organizations in the same environment, likewise the university has the opportunity for students to carry out their internships-stays, make your industrial visits and join the labour market.

Thus, in the State of Puebla there are a total of 2 thousand 140 companies distributed as follows: 125 correspond to large companies, 386 to medium and 1 thousand 629 to small ones as shown in the following graphic:



**Graphic 4** Distribution of companies by size

Of these, 38.1% correspond to the industrial branch, 39.7% correspond to commerce and 22.2% to services (ibid). Where important differences between men and women begin to be seen is in the sectors where they work, for both there is a similar concentration in the sector of independent professionals, but men are more represented in agriculture, industry and government, while women are notably concentrating more on health and education, as shown in the following table.

Sector	Women (%)	Men (%)
Agricultural, Livestock	1.3	3.0
Industry	9.6	19.3
Trade	14.8	13.9
Banking, Finance	4.1	3.6
Transportation,	4.0	4.7
Health	21.0	10.2
Independent professionals	16.6	17.1
Education	17.4	11.2
government	11.3	16.9
Total	100	100

**Table 3** Labor distribution by gender

Source: (Vries, et al., 2015)

### Professional competences related to the functions and work tasks of the TSU

The labor market is expected to have a great capacity for change, so it is vitally important to have trained human resources that skillfully respond to the requirements that it demands.

Thus, within the area of food processes, the basic cognitive, psychomotor and affective skills that meet specific standards of a company or sector are identified by the methodology of identification of requirements and expectations of the labor sector, allowing to establish training programs on learning objectives in a detailed and precise way, achieving satisfactory execution of the demands of the labor market.

This analysis presents the requirements and expectations of the labor sector in the area of influence of the Technological University of Puebla, in relation to the relevance of studies for the professional 5B in food processes and is based on the information obtained from the workshop held in the University facilities, in March 2014. The TSU in Food Processes is a person with knowledge and skills to manage production systems as well as the industrialization of food products through new technologies for the benefit of the unit of production. Through the Analysis of the Work Situation, the specialists gathered in the workshop identified the key tasks of the sector and grouped them by productive function and based on this classification the general purpose of the sector in Agriculture was formulated, which was written as follows way: "Manage the resources and food processes of the company based on the standards and established norms, in order to achieve their optimization, as well as the design and development of new products and / or food processes and in this way satisfy the customer requirements."

During the workshop, five key functions to be developed by the professionals of this career were determined, which are mentioned below.

- Manage quality and safety management systems within the company.
- Orient the production processes according to the client's needs.
- Supervise the agricultural marketing, quality and packaging system.
- Transform food products with efficiency and high performance.
- Manage human and material resources for production.

The labor field for this professional can include agricultural, livestock, poultry and agro-industrial sectors among others, depending on the type and size of the organization, he can work in greenhouses, ranches, government agencies in relation to agriculture, among others. It also opens the possibility for the TSU in Food Processes to form its own company, where it can offer consulting services, automation, maintenance, sale of equipment and / or spare parts and marketing of agro-industrial products.

Some of the positions that a TSU in Food Processes can aspire to are mentioned below:

- Production unit manager.
- Production manager.
- Supervisor.
- Technical.
- Project leader.
- Seller.
- Independent consultant.

The above will depend on the size and business of the company where you work.

You will be able to move up in jobs as you develop and gain experience. His work environment will be very diverse, where he must coordinate and execute production processes, as well as solve problems that arise in production.

It will implement automated systems to improve the efficiency of the production process, as well as the use of natural resources, thereby seeking their sustainability. Coordinate work teams for the proper development of production activities. There is a high degree of occupational risk when carrying out activities caused by: sun exposure, breathing of toxic substances, noise, falls, bumps and cuts, among others.

In the region there is a continuous growth of the population that demands agricultural products, likewise given climate change there are fewer and fewer natural resources such as water where every day it is more scarce and its use is required to the maximum, therefore both the demand for having this profile will increase. Their perceptual faculties must be high since it requires detecting, analysing and processing information that allows them to plan and organize production processes as well as attend to the problems that arise, so it is necessary to work on the development of perceptual faculties.

Features:

- Manage quality and safety management systems within the company.
- Orient the production processes according to the client's needs.
- Supervise the agricultural marketing, quality and packaging system.
- Transform food products with efficiency and high performance.
- Manage human and material resources of production.

Tasks:

- 5.1 Apply quality control at the production control points.
- 5.2 Guarantee the safety of food products.
- 5.3 Apply statistical techniques in the processes.
- 5.4 Ensure the operability and good use of the process measurement and control equipment.

- |   |   |
|---|---|
| 5.5 Identify the customer's needs in food products of interest. | - Increased capacity to attract and maintain investments, especially in the food and housing industry, as well as in health and education services.   |
| 5.6 Support the development of new food products.               | - The greater regional exchange of goods and services, as well as the mobility of people, fostered by the expansion and improvement of infrastructure and means of communication and transportation.  |
| 5.7 Employ new technologies in the development of new products. | - The industrial and commercial specialization of regions and economic zones; especially in the areas of manufacturing, commerce, restaurants and hotels, and services.   |
| 5.8 Investigate commercial markets in the agricultural sector.  | - The greater absorption of the youth Economically Active Population (EAP) in the labor market. It should be noted that according to recent studies, 50% of the business demand of the states of Nuevo León, Mexico, Puebla and the Federal District for the knowledge of graduates of industrial engineering correspond to the areas of: production, quality systems, planning, warehouses, sales and logistics, mainly. The panorama of the Puebla entity that is expected is as follows: |
| 5.9 Monitor the quality of agricultural products.               | 1). A new demographic and family structure in urban areas, mainly.  |
| 5.10 Manage environmental sustainability systems.               | 2). Puebla: "The Capital of Knowledge" or "University City" for permanent education; and Center for Health Care Services.   |
| 5.11 Add value to the primary products of the region.           | 3). A specialized and diversified manufacturing industry.   |
| 5.12 Respect the environment and safety and hygiene.            | 4). A state with regional urban development in process, pressured by the greater demand for public services, mainly water and energy.   |
| 5.13 Increase the effectiveness of the applied processes.       | 5). Research and application of technology to improve and protect the environment, in particular, natural resources and the environment.  |
| 5.14 Manage cost and investment system.                         | 6). Expansion and development of infrastructure and means of transport, especially communications and telecommunications (TICS).  |
| 5.15 Integrate and coordinate work teams.                       | 7). A more democratic and just government, defender of citizens' rights, and active promoter of development.  |
| 5.16 Supervise activities of personnel in charge.               |   |

In this workshop, the information gathering methodology was followed for the development of competency-based study plans, adapted in 1992 by the Quebec Ministry of Education and adapted by the same institution. This methodology allows detecting the psychomotor, cognitive and socio-affective skills necessary to exercise a productive function under performance standards.

Prospective elements of state development

The Vision of the state of Puebla to 2020 is based on a series of trends, among which are:

- The net growth of the state population of 100,000 inhabitants per year on average, with a higher concentration in the main municipalities of the Entity (Puebla, Tehuacán, Huauchinango, San Martín Texmelucan and Atlixco).

**Conclusions**

The labor field of the agro-industrial engineer and the TSU in food processes; It can cover agricultural, livestock, poultry and food industrial sectors in general, among others such as government institutions in the field, depending on the type and size of the organization, it can work in greenhouses, ranches, public agencies in relation to the agriculture, among others. It also opens the possibility for the graduate to form his own company, where he can offer consulting services, automation, maintenance, sale of equipment and / or spare parts and marketing of agro-industrial products.

In the region there is a continuous growth of the population that demands agricultural products, therefore the potential of the development of the agroindustrial engineering career of the BUAP and the TSU in food processes of the UTP, is high with an impact on the region and the very encouraging agro-industrial development. Of course, there are challenges that must be overcome to achieve optimal development, among them the participation of the state, industry and the University is required, thus some items where projects and / or strategies for development can be generated are:

- To form a strong and reliable State, capable of guaranteeing economic stability, food security, and leading the development of productive and social activities, with the participation of industry and the university in triple helix projects that benefit the sector. agro-industrial.
- Motivate state and foreign investment in emerging and high-technology areas, to gradually improve or replace traditional industry with cutting-edge technology.
- promote competitiveness, that is, given the scarcity of opportunities, promote sources of productivity with sustainable bases to generate wealth, increase resources and improve the level of well-being of the population, educational institutions and companies.

- Make agro-industrial education one of the main engines of development, in the poorest and most marginalized regions of the state, to guarantee food security.

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