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Production structure and commercialization of green vegetables in the valley of Tecamachalco, Puebla, Mexico

La estructura de producción y comercialización de hortalizas, en el valle de Tecamachalco Puebla, México

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Abstract

In the current project we have the opportunity to show a study, at a regional level, in the state of Puebla, in the central highlands of Mexico, located in the Balsas Basin; belonging to the Rural Development District of Tecamachalco, Puebla. The object of the study were the vegetable producers, who were interviewed through a questionnaire addressed to 89 producers, to carry out the diagnosis of the production and commercialization of vegetables in the local, regional, state, national, and international market. Within the framework of the TMEC, current legislation requires producers to obtain different certifications to comply with each of the standards that exist in regulations, in national and international markets. Within the value chains, the main marketing channels are Huixcolotla and Iztapalapa's Supply Centers, supermarkets, markets, street markets, and exportations, which prevails in a regional and local market. The field study was carried out in 2021 in the municipalities of Tecamachalco and Palmar de Bravo; the technique was the interview, and the instrument was a questionnaire.

Diagnosis, Market, Green vegetables, Exportation, Regions, Certification

Resumen

En el presente trabajo tenemos la oportunidad de mostrar un estudio, a nivel regional, en estado de Puebla, en el altiplano central de México ubicado en la cuenca del Balsas; perteneciente al Distrito de Desarrollo Rural de Tecamachalco, Puebla. El objeto de estudio fueron los productores de hortalizas, mismos que fueron entrevistados por medio de un cuestionario dirigido a 89 productores, para realizar el diagnóstico de la producción y comercialización de hortalizas en el mercado local, regional, estatal, nacional e internacional. En el marco del TMEC, la legislación actual demanda a los productores obtener diferentes certificaciones para cumplir con cada una de las normas que existen en las regulaciones en mercados nacionales e internacionales. Dentro de las cadenas de valor, los principales canales de comercialización son: central de abasto de Huixcolotla, central de abasto de Iztapalapa, supermercados, mercados, tianguis y exportación; lo que predomina, es un mercado regional y local. El estudio de campo se realizó en el año 2021 en los municipios de Tecamachalco y Palmar de Bravo; la técnica fue la entrevista y el instrumento un cuestionario.

Diagnóstico, Mercado, Hortalizas, Exportación, Regional, Certificación

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Introduction

Packing and exporting companies, this sector has a high level of economic capital and infrastructure. They are in the most important municipalities of the region (Acatzingo, Huixcolotla and Los Reyes) and in the vicinity of the Central de Abasto de Huixcolotla. According to the list managed by the Council of Horticulturists of Puebla outdoors, there are more than 40 packing companies in the region, and they export to the countries that make up the North American Free Trade Agreement (NAFTA, now called TMEC). They are linked to production through farmers who have a regional leadership to establish sale-purchase commitments. To gain a foothold in the regional market, some companies rent warehouses in the municipalities with the highest vegetable production. They demand excellent quality vegetables, offering the best prices, according to small producers.

The social actors that make up the horticultural system of the Tecamachalco valley are structured in a differentiated manner, with diverse economic power, from which small producers establish relationships of negotiation and subordination with input suppliers when acquiring agrochemicals and seeds, because at the same time they offer them technical assistance.

A regional study was conducted on the production and marketing of vegetables in the regional, national and international market and the impact on the regional economy between the municipalities of Tecamachalco, Quecholac, Acatzingo, Tepeaca and Huixcolotla with vegetable producers and marketers, as well as the determination of distribution channels in the Irrigation District of Tecamachalco, Puebla.

Determine the influence of the Central de Abastos de Huixcolotla and regional vegetable production. Identify the crops that predominate in the regional, national and international vegetable markets, carry out an investigation of the main packing companies in the study region.

The Tecamachalco valley aquifer is in the central portion of the state of Puebla, with a surface area of 3,600 square kilometers (km²). It is bordered by the Soltepec mountain range to the northeast; La Malinche volcano to the north; the Zapotitlan mountain range to the south and southwest; and the Tenzo mountain range to the west. Municipalities In this zone there are 29 municipalities totally or partially contained: Acatzingo, Amozoc, Cañada Morelos, Cuapiaxtla de Madero, Cuautinchán, Chapulco, Esperanza, General Felipe Angeles, Huitziltepec, Mixtla, Molcaxac, Nicolás Bravo, Palmar de Bravo, Quecholac, Los Reyes de Juárez, San Salvador Huixolatla, Santiago Miahuatlán, Santo Tomas Hueyotlipan Tecali de Herrera, Tecamachalco, Tepanco de López, Tepatlaxco de Hidalgo, Tepeaca, Tepeyehualco de Cuautémoc, Tlacotepec de Benito Juárez, Tlanepantla, Tochtepec, Xochitlán Todos Santos and Yehualtepec. (CONAGUA, 2020). According to the Federal Water Rights Law 2015, the aquifer is classified as availability zone 1.

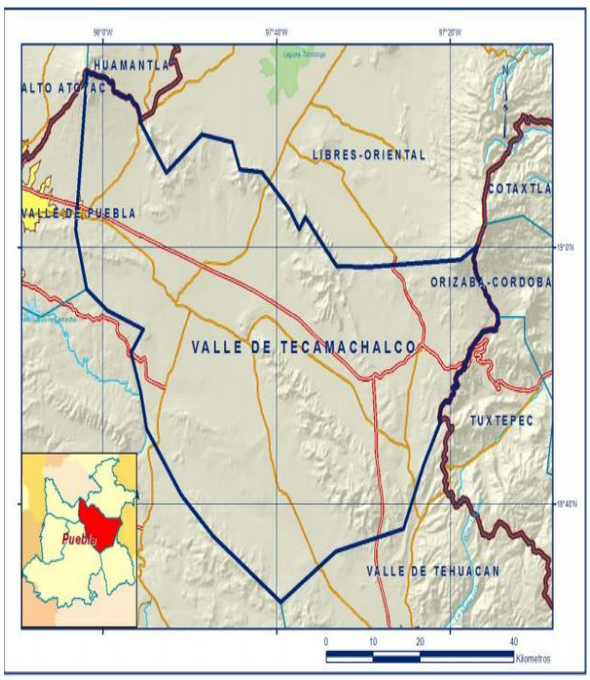

Figure 1
Source: CONAGUA, 2020
https://sigagis.conagua.gob.mx/gas1/Edos_Acuiferos_18/puebla/DR_2101.pdf

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Literature review

The diagnosis has been one of the most used tools for market studies, they have diversified, in terms of markets, products, a study in 2015, in Costa Rica, points out that an alternative can be organic crops, because they have a high added value, Camacho indicates:

The organic vegetable market in the GAM is composed of small and medium producers who offer their products through organic fairs, farmer's fairs, supermarkets, intermediaries, hotels and restaurants, as well as home deliveries. As producers gain seniority, they increase the area dedicated to production, the number of species produced and make the decision to become certified. Producers with less time of dedication have smaller areas and produce a smaller number of species than those with more seniority. And in some cases they have recently embarked on the road to certification (Camacho, *et al*., p. 2015).

Certifications in organic and conventional products are necessary to market in formal markets, supermarket chains, restaurants, and even export is substantial quality control.

According to Soto, *et al*., pp: 1036-1037 (2014): Currently in different entities of Mexico there are networks of tianguistas of organic products, which perform a very important work by marketing, informing, imparting courses, experiences and knowledge to their colleagues, this for consumers is of utmost importance as it modifies attitudes of consumption and creates a great initiative and confidence to continue with a process of consumption of these foods.

The area of organic products is becoming more mature day by day, it is an emerging market that needs to have regulations, which makes this scenario of complicated adoption as it does not have uniformity in different areas such as cultivation, production, processing and the different processes involved in the value chain of each of the products marketed, the current legislation requires producers to obtain different certifications to meet each of the standards that exist in the different regulations either in national and international markets". (Soto, *et al*., p. 1035, 2014)

The opportunities for producers are diverse, the problem in the markets is that the certification process implies an investment that is not considered, this is why training and laboratory tests, as well as field certification, sometimes are not very expensive or there is little knowledge about it, the advantage is that through certifications producers can obtain better benefits.

As main positioning strategies in supermarkets, the consolidation via quality at an affordable price for middle class consumers, regardless of the marketing volume, is pointed out. All this clearly shows the confluence towards the adoption of a cost strategy, consisting in the reduction of production costs and obtaining large marketing volumes that ultimately allows them to obtain greater competitiveness through market prices (Soleno, 2013).

According to Soleno, in a study in Buenos Aires, Argentina, the study of marketing strategies is fundamental in the analysis of costs when determining the value chains among supermarkets, unlike in the present study the value chains are oriented to the central supply centers. Traceability is fundamental in vegetable marketing processes, as indicated by Gil, *et al*., 2010, in a study in Spain:

Traceability, the tracking of the product from the origin (field) to the consumer's table (market) has guided the marketing process in recent years. To this end, they scrupulously program the planning of plantations, the selection of varieties, the preparation of the land, the control of transplanting, harvesting, control at the entrance to the warehouse, packaging and handling, the quality of the finished product, cooling, shipping and delivery after sale. Strict control standards from the field to the supermarket require that each lot or batch be recorded (the plot where it was harvested, the day, the time, the owner, etc.). Even the smallest package carries its identification card (in some companies all by electronic means and bar code or numbering as in most of the sample of companies visited), and it is maintained until the shipment and fractionation of cargo arriving at the supermarket or point of sale (Gil, *et al*., p. 200, 2010).

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The comparative advantages are shown in the geographical location and markets of emerging economies, although Mexico is a country with multiple opportunities, but not all producers can develop the same level of competition, according to Borbón:

Traditionally, Mexico has been the main supplier of fresh vegetable imports to the United States. Today, this dynamic and competitive trade, has given room for other countries to also have a presence in the U.S. fresh vegetable markets. Such is the case of: Canada, Honduras, Dominican Republic, Spain and Holland, which stand as some examples of the competition faced by Mexican exports, to such a degree that they concur with homogeneous product in terms of: health, quality and safety, eventually influencing a reduction in the market share that our country served. (Borbón, *et al*., p. 43, 2018).

Methodology

The information collected was classified into primary and secondary, the first concerns obtaining information through questionnaires, interview forms, research guides, ordinary observation, the second refers to information extracted from documentary sources, censuses, vital statistics, through statistical tables, the secondary information serves as a basis for the analysis of the problem, in the collection of information, producers and leaders of organizations in the region were interviewed who provided first-hand information on the different aspects of the study. The field work was carried out using a random sample of producers with which we can make inferences from the results obtained in the survey applied to the target population.

Technique and instrument used

The technique whether survey, structured interview, or observation has its own limitations in the research. The survey was the technique used to explore certain aspects of the population; it was also necessary to use observation and key informant interviews. About the experience in economic studies, the selected technique was the survey, this technique consists of the collection of a part of the population called sample, data, opinions, through questions formulated on various indicators, the information obtained is processed in a quantitative analysis, to identify and understand the magnitude of the problem, the instrument used was the questionnaire.

The questionnaire was addressed to representatives of organizations and producers, where the questions asked were aimed at finding out the specific aspects of the variables, the exploration of which can be with one or more questions, and sometimes a single question was used to investigate one or more variables.

1) Gathering information from secondary sources.

The first phase consisted in the compilation of bibliographic information related to the research problem in books, newspapers, theses and magazines, in the libraries of the B.U.A.P., El Colegio de Postgraduados and newspaper and periodical libraries. Subsequently, secondary or statistical information was collected in I.N.E.GI. (Censuses, Yearbooks and municipal notebooks) in the city of Puebla, as well as the consultation via Internet of the official pages of I.N.E.G.I., SADER, for this stage the method of bibliographic synthesis was used, using the instrument denominated bibliographic work card, with the information obtained a data base will be made to interpret the situation of the coffee production at national, state and municipal level.

2) The second phase involved trips to the study municipalities in order to have contact with key informants: municipal authorities, representatives of farmer organizations, intermediaries and producers. The purpose of this activity was to identify the regional marketing channels, as well as to identify the main points of sale, in central supply centers inside and outside the State of Puebla, and to find out where these organizations sell the product at wholesale and retail.

3) The third phase consisted of the elaboration of questionnaires to be applied in the organizations in the municipalities of study, the interviews were carried out in the second half of July and the first half of August, applied in the municipality of Tecamachalco. The interview technique was used, using a field notebook and questionnaire guide.

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4) Coding and processing of the information the next phase was the emptying of the information obtained in the questionnaires in tabular sheets, to create a data base by key, subsequently the analysis of the data was made in the program Statstical Pachage for the Social Sciences (S.P.S.S.).

Sample design

Information was sought on the coffee growers in this region and the list of problems was obtained through the coffee census, this census includes information that will allow us to determine the necessary sample size, the first thing that was done was to identify a variable that gives us information related to the topic of research and was dedicated to using the number of farms as a necessary variable to determine the sample size in the first stage was to identify the number of farms total farms that were located in the two municipalities studied, In the calculation of the average and variance, as well as other important measures of each of the municipalities contemplated in the study.

The size of the sample of producers

Upon analyzing the information, it was determined that the appropriate sampling scheme for these data was a random stratified sampling, and due to the differences in the population sizes of each stratum, it was decided to allocate the data proportionally to each of the municipalities.

The equation for estimating the sample size in a random stratified sampling with proportional distribution is explained as follows:

Equation 01. Mathematical expression for calculating the sample size in a stratified random sampling with proportional distribution

$$n = \frac{N\sum_{i=1}^{k} N_i s_i^2}{N^2 V + \sum_{i=1}^{k} N_i s_i^2}$$

dα/2 Accuracy
Z Reliability
N Population size
Ni Population size of stratum i
S²i Variance of stratum i

Relationship between precision and reliability for the sample size calculation in equation 1.

$$V = \frac{d^2}{Z^2\, \alpha/2}$$

Equation 2. Assignment of sample size to each of the strata.

$$n_i = \frac{Ni}{N} n$$

It was decided to use a precision of 15% of the general mean and a reliability of 90%, so with information obtained on the size of the strata and their variances we have the following information:

Substituting the data previously shown in equation i, we obtain the following data, the size of the sample in each of the municipalities, with a precision of 15% of the general mean and a reliability of 95%, the size of the strata is established as follows:

Municipality	Sample size
Palmar de Bravo	n1 = 50
Tecamachalco	n2 = 39
Total	n = 89
N= 1890	

Table 1 Sample size of the municipalities studied

The sample design was stratified sampling.

Results

The research was carried out in the field, with vegetable producers, who use greenhouses and most of them are in open sky, in the municipalities of Tecamachalco and Palmar de Bravo, where the region has irrigation system, and innovative methods and techniques in intensive production, also the strategic location of the supply centers of Huixcolotla, Puebla and Mexico City, the markets are predominantly local, due to the connectivity between federal roads and highways, between the capital of the Mexican Republic and the southeast. The highway network is one of the strategies in the marketing process.

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Figure 2

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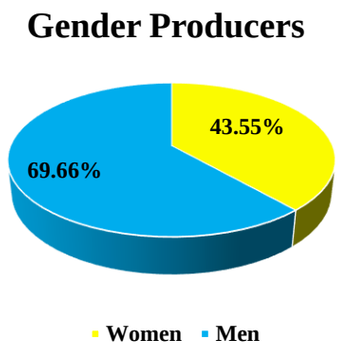
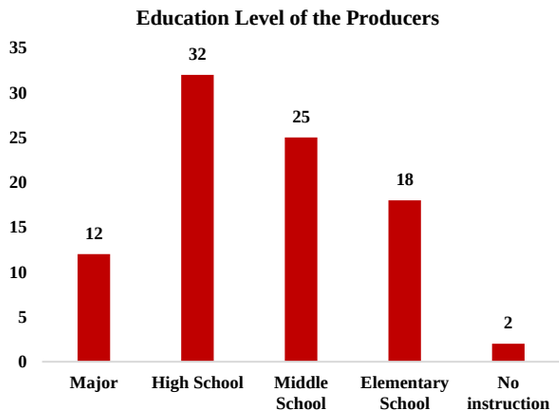
Figure 3

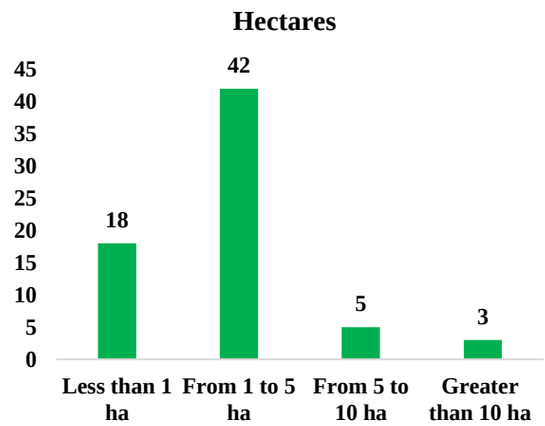


Graphic 1
Source: Own elaboration, obtained in the field, 2021

Of the sample of 89 producers, 69.66% are men and 30.44% are women. In terms of education, 32 have a high school diploma, 25 have a high school diploma, 18 have a primary school diploma, 12 have a bachelor's degree and 2 have no education.



Graphic 2
Source: Own elaboration, obtained in the field, 2021



Graphic 3
Source: Own elaboration, obtained in the field, 2021

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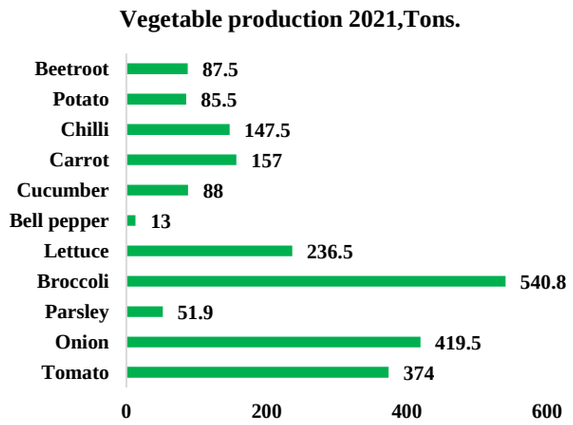
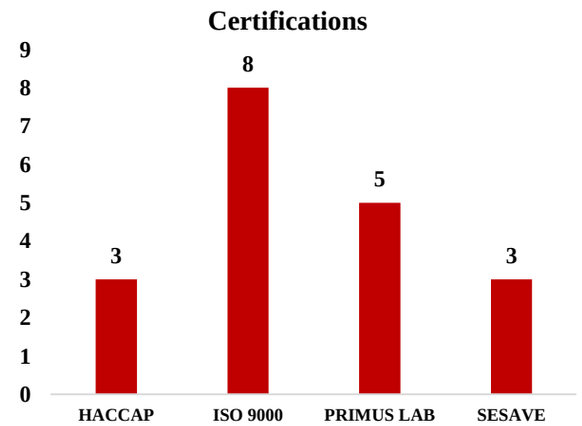


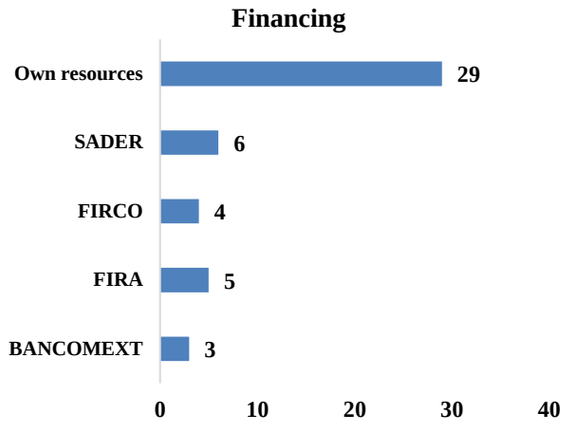
Graphic 4
Source: Own elaboration, obtained in the field, 2021

According to the volume of production, the crop with the highest production in tons is broccoli with 540.8 tons, followed by onion with 419.5 tons, tomato with 374 tons, lettuce with 236.5 tons, carrot with 157 tons and chili with 147 tons, and the rest of the crops produce less than 100 tons. This allows us to analyze the demand among the main products in the market. The main range of hectares per producer is 1 to 5 hectares.

Regarding certifications, 8 producers have ISO 9000, 5 PRIMUS LAB, 3 HACCAP and 3 SESAVE, this shows that most of them do not have certifications.



Graphic 5
Source: Own elaboration, obtained in the field, 2021



Graphic 6
Source: Own elaboration, obtained in the field, 2021

Financing is one of the main obstacles in the process of production and commercialization of vegetables, 29 producers expressed that they carry out operations with their own resources, while only 4 have support from FIRCO and 5 FIRA, 6 from SADER programs and 3 from BANCOMEXT, this indicates that there is very little institutional support from development banks and multiple banks in the agricultural sector.

Annual sales income is mostly determined by sales of less than $100,000 MXN, but 11 cases were also found with sales greater than $100,000 MXN.

Graphic 7
Source: Own elaboration, obtained in the field, 2021

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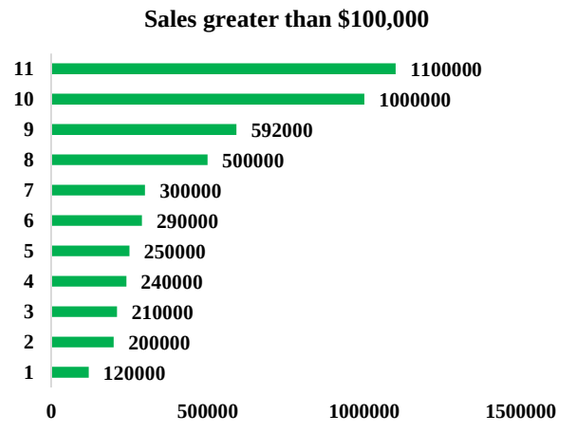
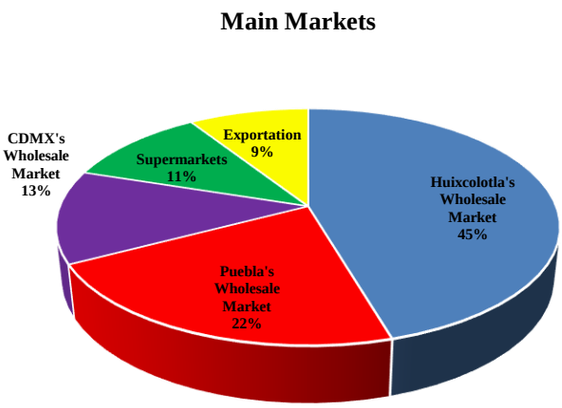


Graphic 8
Source: Own elaboration, obtained in the field, 2021



Graphic 9
Source: Own elaboration, obtained in the field, 2021

Figure 4 Central de Abastos Huixcolotla
Source:
https://earth.google.com/web/search/central+de+abastos+HUIXCOLOTLA/@18.90359623,97.78399063,2017.42073665a,1433.52015029d,35y,3.52147071h,9.89093538t,0r/data=CigiJgokCRIPGg7_RCVAEVYLMhls3iRAGZkd9u9rq1DAIXAle8CLxlDA

Figure 5 Central de abastos Iztapalapa, CDMX
Source:
https://earth.google.com/web/search/central+de+abastos+iztapalapa/@19.3814174,99.0908143,2233.48478268a,989.89732007d,35y,0h,0t,0r/data=CigiJgokCXYOTgLt6TJAEUQz4sNh2jJAGVYgHTPBcVjAISKCFxW2dVjA

Conclusions

The Tecamachalco valley region is very productive in broccoli, onion, tomato, lettuce, carrot, beet, parsley, and cilantro crops; there is an intensive production system with greenhouses and open field, most of the producers have a land extension of 1 to 5 hectares, there are producers that have 15 to 20 hectares, but they are a minority.

The migration factor is present in the participation of women in the production and commercialization of vegetables, 70% are men and 30% are women, this characteristic is very present in the municipalities in the Migratory intensity index.

The main markets of the producers interviewed indicated that 45% sell in the Central de Abastos de Huixcolotla, 22% in the Central de Abastos de Puebla, 13% in the Central de Abastos de Ixtalapa CDMX, 11% in supermarkets and 9% for export, it should be noted that a part is also destined for local markets and retail markets.

One of the serious problems faced by producers is the lack of financing for productive projects; only some producers mentioned that they had financing from FIRA, FIRCO, BANCOMEXT and SADER; most do not have financing, so they carry out their activities with their own resources.

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Another problem faced by producers are certifications, this is due to the fact that in the current legislation at national and international level, the norms that regulate the vegetable markets must meet the quality controls, through laboratory studies for certification, so most of the producers interviewed do not have certifications. The certifications found in the study are ISO 9000, PRIMUS LAB, HACCAPA and SESAVE, which is a limitation for producers to find better markets where they receive better remuneration.

Based on the diagnosis that has been made, it is advisable to design some public policies in the value chains in the marketing channels and see what are the factors that influence finding better markets or the transformation of the products to obtain a higher added value, seeking alternatives to improve the producers' income.

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