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Support the international scientific community in its written production Science, Technology and Innovation in the Field of Social Sciences, in Subdisciplines of Market structure, Firm strategy, and Market performance: Production, Pricing, and Market structure, Size distribution of Firms, Monopoly, Monopolization strategies, Oligopoly and Other imperfect markets, Transactional relationships, Contracts and reputation, Information and Product quality, Industrial Organization and Macroeconomics, Macroeconomic industrial structure; Firm objectives, Organization, and Behavior: business objectives of the Firm, Firm organization and Market structure, Vertical Integration, Organization of Production, Firm Size and Performance; Nonprofit organizations and Public Enterprise: Nonprofit institutions, Public enterprises, Boundaries of public and private enterprise, Privatization, Contracting Out; Antitrust policy: Monopolization, Horizontal anticompetitive practices, Vertical restraints, Resale PRICE maintenance, Quantity Discounts, Legal Monopolies and Regulation or Deregulation, Antitrust policy and public enterprise, Nonprofit Institutions, and Professional Organizations; Regulation and industrial policy, Economics of regulation, Industrial policy, Sectoral planning methods; Industry studies: manufacturing, Metals and Metal products, Cement, Glass, Ceramics, Automobiles, Other transportation equipment, Microelectronics, Computers, Communications equipment, Other Machinery, Business equipment, Armaments, Chemicals, Rubber, Drugs, Biotechnology, Food, Beverages, Cosmetics, Tobacco, Other Consumer Nondurables, Appliances, Other consumer durables; Industry studies: Primary products and construction, Mining, Extraction, and Refining: Hydrocarbon fuels, Other nonrenewable resources, Forest products, Construction; Industry studies: Services, Retail and wholesale trade, Warehousing, Entertainment, Media, Sports, Gambling, Recreation, Tourism, Personal and professional services, Real estate services, Information and internet services, Computer software; Industry studies: Transportation and utilities, Transportation, Railroads and Other surface transportation, Air transportation, Electric utilities, Gas Utilities, Pipelines, Water utilities, Telecommunications, Utilities, Government policy.

Market structure, business strategy and market funtioning, Objectives, organization and behavior of the company, Non-profit organizations and public enterprises, Politics of defense of the competition, Regulation and industrial politics, Sectorial studies: Manufactures, Sectorial studies: Primary products and construction, Sectorial studies: Services, Sectorial studies: Transport and basic supplies.

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Presentation of Content

In the first article we present, *Determining metalworking shop's characteristics as an indirect exporter of maquiladora industry in Ciudad Juarez*, by VILLESCAS-URIBE, Luis Andrés, CASTILLO-PÉREZ, Velia, ALAMILLA-OCAÑA, Luis-Jesús and MARTÍNEZ-QUIROZ, Angélica Cristina, with ascription in the Instituto Tecnológico de Ciudad Juárez, as following article we present, *Application of the contingent valuation method in order to determine economic value of environmental impact of a hydroelectric dam*, by HERNÁNDEZ-PERALTA, Alejandro de Jesús, RUIZ-LÓPEZ, Carlos Alberto , CRUDET-BALDERAS, Juan Carlos and MARTÍNEZ-NAVARRETE, Daniel, with ascription in the Universidad Tecnológica del Centro de Veracruz, as following article we present, Guidelines for the manufacture of scaffolds used in tissue regeneration, by FLORES-CEDILLO, María Lisseth, SIERRA -GUERRERO, Adela Marisol, MORALES-BARBOSA, Ma. De la Luz and TÉLLEZ-ESTRADA, José, with affiliation at the Instituto Tecnológico Superior de San Luis Potosí, as last article we present, *Preparation and implementation of a manual of Good Poultry Practices in a bird incubator plant in the central area of the state of Veracruz*, by RENDON-SANDOVAL, Leticia, GUTIERREZ-PEÑA, Esteban, REYES -SAMPIERI, Dalila and AGUILAR-SERRANO, Anaisa, with secondment in the Instituto Tecnológico Superior de Huatusco.

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Determining metalworking shop´s characteristics as indirect exporter of maquiladora industry in Ciudad Juarez

Determinación de las características de los talleres metalúrgicos como exportador indirecto de la industria maquiladora en Ciudad Juárez

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Abstract

Maquiladoras and metalworking shops maintain a business relationship between large companies and small businesses. Workshops are distinguished by producing low volume and wide variety of products. This study analyzes the characteristics of metalworking shops and indirect exporters in the maquiladora industry. It was conducted by applying a questionnaire to five companies, where the characteristics of the company were searched, their strategies, technological capabilities, learning and innovation, quality, linkages with other organizations, environmental assessment and public policy. Sampling was used for convenience. Among the results they were: the workshops are in room houses the operating time between two and 23 years, manifest not belong to any association or chamber to operate the difficulties expressed are hiring qualified employees, quality control, most of the staff is operating; measuring equipment are the most used digital vernier, digital calipers and machines with coordinates; expressed ignorance about the actions or specific programs for this sector promoted by the federal, state or municipal government. It is recommended to extend the sample in future research.

Metalworking shop´s characteristics, technological capabilities, learning and innovation, quality.

Resumen

Las empresas maquiladoras y los talleres metalmecánicos mantienen una relación comercial entre empresas grandes y empresas pequeñas. Los talleres se distinguen por producir volúmenes bajos y amplia variedad de productos. El presente estudio analiza las características de los talleres metalmecánicos como exportadoras indirectas de la industria maquiladora. Se realizó mediante la aplicación de un cuestionario a cinco empresas, donde se buscaron las características de la empresa, sus estrategias, capacidades tecnológicas, aprendizaje e innovación, calidad, vínculos con otras organizaciones, evaluación del entorno y políticas públicas. El muestreo utilizado fue por conveniencia. Entre los resultados encontrados fueron: los talleres se encuentran en casas habitación, el tiempo de operaciones oscila entre dos y 23 años, manifiestan no pertenecer a alguna asociación, o cámara, las dificultades manifestadas para operar se encuentran contratar empleados calificados, controlar la calidad, la mayoría del personal es operativo; el equipo de medición que más utilizan son el vernier digital, calibradores digitales y las maquinas con coordenadas; manifiestan desconocimiento sobre las acciones o programas específicas para este sector promovidos por el gobierno federal, estatal o municipal. Se recomienda ampliar la muestra en una investigación futura.

Características de talleres de maquinado, capacidades tecnológicas, aprendizaje e innovación, calidad

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Introduction

The metalworking sector is one of the most important in economic development of Ciudad Juarez; however, there is a weakness in administrative and technological capacity of the associative processes in this sector, as well as the need to integrate into global value chains. The main activity of Workshops Metal Mechanical is the manufacture and repair of metal parts, commonly referred machined, machinery of any branch of manufacturing. The production system that characterizes workshops is low volume and high variety of product designs.

There are studies that examine the emergence and development of the characteristics of workshops or machining centers in Ciudad Juarez, Mexico, others presenting the barriers faced by small businesses to integrate as suppliers of the maquila, highlighting the advantages offered them work mechanisms used in joint and support requirements of state bodies.

This study aims to analyze the characteristics of small and medium-sized metalworking companies, and indirect export maquiladora industry in Ciudad Juarez, in relation to strategies, certifications and links to the town.

Information field are carried out using a structured questionnaire containing 44 questions, organized in 10 sections. 1) data of the interviewee; 2) general data of the company; 3) Information on the owner; 4) Feature of the company; 5) Corporate Strategy; 6) capabilities; 7) Learning and innovation; 8) Quality; 9) Link to other organizations; 10) Evaluation environment and public policy.

Among the results they are: The workshops are located in room home not identified as business. They are national and independent companies are not part of an association, camera, Canacintra. 71% of production is manufacturing parts and about 19% is repair of machine parts, equipment, 8% manufacturing metal structures and the remaining 2% maintenance. All manifest technical experience in the maquiladora industry.

Problem Statement

At present most of the owners of micro, small and medium enterprises, (SME), come from previous wage labor and the economically inactive population. Most of the founders of these companies created based on economic, since for low incomes as employees or simply not find work as employees, without having an intuition as an entrepreneur, which causes these businesses are not managed properly (Luna Correa, 2012).

SMEs are limited to big business, but this more than anything by the unfairness that exists, although SMEs are the following limitations; get customers, hire qualified, financing, getting suppliers, obtain equipment, adapt their products to the customer, lack of market information, product quality, management company Workers (Luna Correa, 2012).

Hernández Contreras, (2011) mentions that the main constraints of SMEs are due to lack of knowledge entrepreneur, who mostly do not have the necessary management skills to enable them to advance and grow, Limiting acquires technology and points already mentioned causes is minimal growth of these small and medium enterprises.

A widespread problem among SMEs is their limited ability to offer differentiated and innovative products or services due partly to the low degree of technological complexity they have, although in some cases developing countries are presented

Companies that have the ability to overcome major obstacles, which may be, lack of expertise, poor access to technology, inputs, markets, information, financial credits and the acquisition of external services (Mendoza León, 2013).

Problem Definition.

This research analyzes the characteristics of small and medium-sized metalworking companies, as indirect export maquiladora industry in Ciudad Juarez, in relation to strategies, certifications and links. (Pymes.org.mx, 2016)

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Methodology to Develop

This research is quantitative, not experimental, transeccional, descriptive; data collection was performed on a single occasion. The type selected by convenience sampling, because only five companies agreed to give information. (Hernández Sampieri, Fernández Collado, & Baptista Lucio, 2010)

For field information, gathering it was conducted using a structured questionnaire. The questionnaire was taken from the global project production networks and local learning presented by the resilience of companies that even when passing large and persistent difficulties come forward and incorporated into global supply chains. The instrument containing questions organized into 10 sections whose contents are listed below: 1) data of the interviewee; 2) general data of the company; 3) Information on the owner; 4) Feature of the company; 5) Corporate Strategy; 6) capabilities; 7) Learning and innovation; 8) Quality; 9) Link to other organizations; 10) Evaluation environment and public policy.

Respondents were ex mate's college and friends, shop owners machining. The survey was conducted in machine shops. People filled the questionnaire as signed and sealed to give reliability to these documents

I. Details of the interviewee.

Where He works and since when He occupies this position.

II. General Data.

Which Association or chamber they belong to.

III. Owner data.

IV. Company Strategy

A. The most important actions that have been implemented in their company over the past five years.
B. The main difficulties in the operation of their company.
C. The main attributes that should be a worker to be hired in your company.

V. Technological capabilities

A. Total workers during the following periods.
B. Distribution of staff.
C. Units machinery and major equipment.
D. Characteristics of the machinery.
E. Programs.
F. Training

VI. Learning and innovation.
A. Learning techniques to increase knowledge in the company.
B. Innovation activities

VII. Quality
A. Quality certifications
1. ISO
2. QS
3. TS
4. CEP
B. Certification Process
C. Activities carried just the company to ensure quality.
D. Where equipment and measuring devices are calibrated to ensure product quality.

IX. Assessment and public policy environment
A. Knowledge of programs or specific actions for their promoted by the federal government sector.
B. Knowledge of programs or specific actions for their promoted by the state government sector.
C. Advantages and Disadvantages associated with the company in Ciudad Juarez.
E. Government policies could contribute to the competitive development of enterprises in the sector.

Analysis and Results

The survey was conducted into five workshops entrepreneurs. The survey results are:

General Information

The workshops are located in room home not identified as business. They are national and independent companies; they are not part of any association or camera, neither Canacintra Camera.

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Owner Data

The degree of studies is three with baccalaureate degree and two with bachelor degree. All manifest technical experience in the maquiladora industry.

One of the companies' owners manifests machining studies at the technical level; most machine shops had trained into another branch.

Company Features

71% of production consists on manufacturing parts and about 19% on repair machine parts and equipment, 8% manufacturing metal structures and the remaining 2% maintenance services.

The contracts are handled as purchase orders; they manage an average of three maquiladoras as major customers. All sales are local. Availability of labor, available infrastructure (road energy, transport, telecommunications) and proximity to suppliers of inputs and equipment are the main advantages that machine shops in Juarez have.

The workshops are located in room home not identified as business, due to crime and the growing wave of assaults, threats and extortion and kidnappings that terrorize the society and collapse business. Kidnappings entrepreneurs, businesses burned for nonpayment fees, present a serious situation and employers are afraid of their own safety. Several of these businesses had already closed because they were intimidated; the remaining develops their activities at not identified bedroom home as it was previously mentioned.

Some workshops are family business passed down from generation to generation; in certain cases people who worked in maquiladoras acquired money and knowledge to start their own business. Owners manifest experience as technicians in the maquiladora industry. Most of these workshops owners began working in the maquiladora industry.

Company Strategy

Acquisition of new technologies is very difficult to obtain for these companies. They are focused on get new customers and diversify the range of products. Machinery and equipment acquisition is one of their main objectives.

Technology capabilities

Most shops got used machinery since the cost of new ones is very high; as well as other technologies acquisition (software, licenses, and patents). Normally they use conventional machinery.

Learning and innovation

Workshops performed innovation activities infrequently. Learning techniques used to increase knowledge of their company; it is the training of their staff; very few projects are performed with suppliers and in joint projects with universities or research centers are also rare.

Quality

The five workshops do not have any certification of any quality.
Not calibrate their instruments because the costs are very high. They rather prefer to buy new ones.

Environment and public policy evaluation along with links with other organizations in the locality.

They are not involved in activities of formal or informal cooperation with other organizations; they also lack of knowledge about programs or specific actions aimed at enhancing the sector promoted by the federal or state government.

Conclusions

The companies' years of operation are between two and 23 years; 2, 6, 7, 7, 23 years of operation.

1. Companies are looking for new customer's development; ways to acquire machinery and equipment; decreased production times and improved processes development.

2. The main difficulties manifested are: hire qualified employees and produce quality.

3. They expressed that main attributes that should have a worker to be hired in their company are work experience, followed by a certificate or degree accreditation.

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4. It is stated that the number of workers has doubled over time from two to five employees in four of them.

5. The distribution of staff is twenty-five percent administrative and 75 percent operational.

6. The machinery and equipment in usage are 15conventional milling machines, counting all companies; they count also with conventional lathes and flat rectifiers, handsaw and electrode welding. The tool has been bought of second use; only the drilling are bought new.

7. Conventional milling machines have three axes and two winches.

8. Four workshops do not handle the production scheduling; only one manifested the usage of Bod cat-Cam Version 28.

9. None of the workshops count with engineers; only, two workshops owners have engineering degree, but its function is administrative; most of technicians work in different areas including design; only one workshop manages CNC. The years of experience range that employees possess is between 6-20 years.

10. None of the workshops has given training during three years because the technicians are already qualified to work in designated areas according to owners.

11. 78% is the capacity used in workshops. Turnover is 7%.

12. The five workshops give training to their staff. Only one workshop develops joint project with suppliers. Two workshops perform projects with customers and only one participate on joint project with research or research centers.

13. Machinery and equipment acquisition is one of their main objectives for machine shops, then it's software quality management or organizational modernization (total quality, process reengineering, just in time, etc.) and adaptation to acquired technology.

14. Do not have obtained certifications.

15. The machine shops do not perform calibration program activities, neither metrology quality control computer; they elaborate one set up for each piece.

16. Workshops do not calibrate their equipment by high costs of measuring equipment. They buy measurement equipment

17. The digital vernier and digital gauges are the most used instruments followed by coordinates measuring machines.

18. Only one workshop using ten-thousandths, the rest use thousandths.

19. All workshops have been involved in cooperation with other organizations.

20. Also workshops develop activities formal or informal of mutual cooperation with other organizations.

21. The machine shops, has relationships with suppliers of equipment, raw materials and service, customer, competitors. Also with for testing institutions, testing and certification, affiliated companies.

22. The five workshops share design capabilities, production capabilities, support each other in technology inclusion. They have open doors with each other.

Administrative and technological enterprises machining features are out of step with strategies, certifications and links.

Thanks

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Application of the contingent valuation method in order to determinate economic value of environmental impact of a hydroelectric dam

Aplicación del método de valoración contingente para estimar el valor económico de los impactos ambientales de una dam hidroeléctrica

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Abstract

This study had as a goal to estimate the economic value of possible environmental impact derivate from construction and operation of hydroelectric dam at Los Pescados River, from La Antigua Basin, trough application of Contingent Valuation Method (CVM) at the municipalities of Jalcomulco and Tuzamapan, in the Mexican State of Veracruz. This study found a Willing to Being Repaid by a monthly amount of 42 thousand and 854.17 Mexican Pesos, being the level of education and the readiness of engage in a temporal labor its main determinant factor. Moreover, inhabitants revealed being ready to engage in order to contribute to restore the environmental impact trough hours of communitarian labor, as an approximated measure of the Maximum Willing to Paid.

Economic value, Contingent Valuation Method, Logistic Regression

Resumen

El presente estudio tuvo como objetivo estimar el valor económico de los posibles impactos ambientales que originaría la construcción y operación de la dam y central hidroeléctrica en el río los Pescados de la cuenca del río la Antigua a través de la aplicación del Método de Valoración Contingente (MVC) en los municipios de Jalcomulco y Tuzamapan en el estado de Veracruz. Se encontró una Disposición a ser Compensado (DAC) promedio igual a $42,857.14 MXN mensuales, siendo el nivel de escolaridad y la disposición a participar en un empleo temporal sus principales determinantes, por otra parte, los habitantes revelaron estar dispuestos a contribuir a restaurar los impactos ambientales a través de horas de trabajo como una medida aproximada de la Disposición Máxima a Pagar (DAP).

Valor económico, Método de Valoración Contingente, Regresión Logística

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Introduction

The dams and hydroelectric power stations have been instruments of planning for the development and modernization of the productive apparatus for the majority of the countries in the world, however, in the last decades their viability has been questioned to foment the growth in the countries from the point of sustainable sight, given the environmental and social costs that they generate when being projects of occupation and modification of a part of the territory belonging to a hydrological basin. According to (Kirchherr and Charles, 2016) the conceptualization of the social impacts inherent to the development of infrastructure is a complex process to understand in which different variables must be considered. (Shields, 1975).

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	Direct
Upstream	1. Sedimentation and nutrient loading 2. Over-saturation and death of fish 3. Stratification 4. Loss of habitat that occurs when the reservoir is filled with flora and fauna 5. Alteration of tectonic activity and seismic effects 6. Loss of habitat due to the construction of a camp for workers
Downstream	1. Alteration of the ecological flow 2. Decrease in nutrients 3. Changes in river water temperature, degradation of water quality, loss of spawning sites and migration of fish is prevented 4. Artisanal fishing and traditional agriculture of alluvial lands are interrupted due to changes in flow and reduction of sediments (linens)

Table 1 Main direct social and environmental impacts

	Indirect
Upstream	1. Higher quality water is produced for irrigation, industrial and human consumption 2. Soil erosion 3. Emission of greenhouse gases 4. Forced and involuntary displacement of people seated in the place of construction of the reservoir 5. Increased pressure on the high areas above the dam, as a result of the resettlement of people from flooded areas
Downstream	1. Increased demand for fertilizers to maintain agricultural productivity; 2. Changes in the use of land due to the reduction of alluvial lands; 4. Increase in water-related diseases: malaria, schistosomiasis; 5. Decreased productivity in agricultural and alluvial lands;

Table 2 Main indirect social and environmental impacts

The cost-benefit analysis of development projects such as hydroelectric dams requires taking into account not only the economic costs and benefits derived from the project (Zarfl et al, 2014), but also the environmental and social costs that it generates during its construction and operation. , these costs would have to be added to the economic costs and compared with the benefits that it would generate, in order to make a better decision to carry out the project and not to be socially, environmentally and economically feasible to take into account other alternatives to the generation of it.

The application of economic valuation methods to estimate the environmental costs generated by dams and hydroelectric projects are very few in the case of developing countries such as Mexico, according to the authors Alp and Yetis (2010). These authors applied the Contingent Valuation Method (MVC) to estimate the environmental costs derived from the Yusufeli project, which consisted of the construction of a dam and hydroelectric power station in Turkey on the C Oruh River, through the design and application of a questionnaire to 289 people, through random sampling and a multiple regression analysis, estimated an average Maximum Disposal to Pay (DAP) of 761 dollars and a total DAP of 261 million dollars.

The authors Han, Kwak and Yoo (2008) applied the method of choice experiments (EE) to measure the economic value of the multiple environmental impacts of the construction of large dams in the Tong River in Korea, they found a total annual DAP near to 174.9 million dollars from 804 people from a sample formed by 7 metropolitan areas applying random sampling.

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In the case of Mexico, no economic valuation studies have been carried out that originate the environmental impacts caused by the construction or operation of hydroelectric dams from the methods offered by environmental economics; however, the authors Bernal and Chávez (2015) carried out the evaluation of the environmental impact of the tinder project making inclusion of citizen participation in its planning, the authors show the results of a process of social and organizational learning among the stakeholders in the project and along with it the construction of impact strategies- socially acceptable mitigation.

When the Electricity Works and Investments Program for 2011-2025 was published in 2010, by the Federal Electricity Commission (CFE), 510 hydroelectric projects were announced nationwide, of which 112 correspond to Veracruz. Among these works was the construction of a dam and hydroelectric power station in the La Antigua River basin on the Pescados River between the municipalities of Jalcomulco, Tuzamapan and Tlaltetela, which would have the following functions: electric power generation and water supply to the city of Xalapa, capital of the state. The project consisted of the following aspects:

1. Build a dam that had a curtain 100 meters high and 700 meters long.
2. A hydroelectric power plant that will generate energy to supply 300 thousand inhabitants.
3. The reservoir of the dam of 400 hectares with a capacity of 135 million cubic meters.

Taking into account that the International Commission of Large Redams (2014) defines a large dam as one that has a minimum height of 15 meters or that with a height of between 10 and 15 meters, but with a reservoir of more than 3 million m3 , the dam can be considered as a big dam, being able to manifest some of the environmental impacts of tables 1 and 2. The objective of this research was to contribute to the analysis of environmental and social impacts through an economic estimation using the contingent valuation method (MVC).

The impact of the possible construction and operation of the dam and hydroelectric power station in the Los Pescados river of the La Antigua river basin in the municipalities of Jalcomulco and Tuzamapan in the state of Veracruz considering the Disposition to be Compensated (DAC) and the Maximum Disposition to Pay (DAP).

Study area

Figure 1 shows the possible location of the dam and hydroelectric power station to be carried out in the La Antigua river basin in the Los Pescados river (SIALT, 2015). The highlighted blue line shows the Los Pescados river and the red star its possible location; upstream of the location of the dam are the localities of Tuzamapan, Llano Grande and the municipality of Tlaltetela, while downstream the municipalities of Jalcomulco and Apazapan.

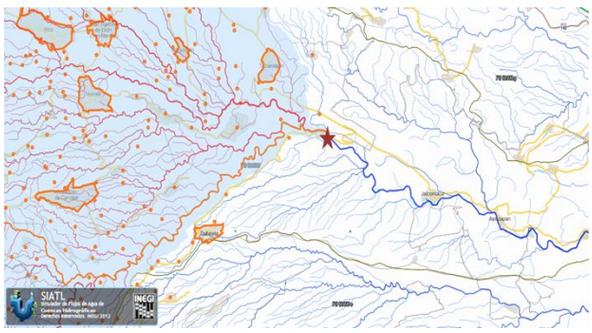

Figure 1 Location of the dam and hydroelectric power station.
Source: Hydrological Waters Water Flow Simulator, SIALT (2015)

According to the hydrographic network upstream 2000 meters of the possible location of the dam[1], the main urban localities of a total of 27 that are crossed by the tributary rivers of the Pescados River are: Tuzamapan and Llano Grande together with the municipality of Tlateltetela. While waters below 2000 meters of the possible location of the dam, the urban municipalities that would be affected by the river recessing and the alteration of the ecological flow are Jalcomulco, Apazapan and Rinconada, below White House and National Bridge and around of 30 rural localities which are distributed in the same territory.

[1] The orange dots represent the rural localities distributed in the territory that have a population of less than 2500 people and those that are encuentran en el contorno anaranjado son urbanas o iguales o mayores a 2500 (SIALT, 2015).

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Even though it can be observed that a greater number of localities and municipalities are distributed upstream of the location of the dam, downstream the greatest environmental and social impacts are concentrated as the loss of the important use values that the river provides directly to the development of consumptive activities: tourist and social in the municipality of Jalcomulco, these define the productive vocation and main economic activity of the municipality.

Figure 2 shows the types of forest that are put at risk: the medium forest subcaducifolia -represented by the purple areas- and the low deciduous forest -represented by the red areas-, The medium subcaducifolia forest is the one that would be most affected, and, why, the flooding of the area would require its devastation and the habitats that it maintains both in flora and fauna, taking into account that it is already scarce in the basin since it represents only 0.914% of the vegetation cover that is located in the La Antigua River Hydrological Basin (DOF, 2012).

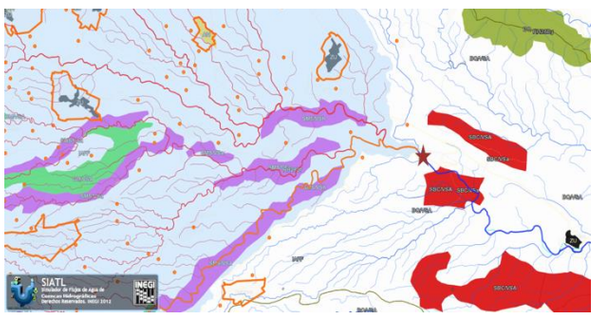

Figure 2. Types of vegetation upstream and below the location of the dam
Source: Hydrological Waters Water Flow Simulator, SIALT (2015)

While downstream the type of forest that is put at risk is the deciduous forest near the municipality of Jalcomulco, which represents 5,085% of all plant cover on the basin, this forest and the habitas that it maintains would be affected as a result of the alteration of the ecological flow (DOF, 2012).

As can be seen, the number of communities and municipalities that are located downstream of the possible location of the dam is smaller, since in this space the environmental impacts are more severe in terms of the alteration of the ecological flow and its importance to develop and maintain diverse economic activities and ecosystem functions. Given that there is no environmental impact statement that shows the local environmental impacts that would add to the economic and social costs of the project, as well as the possible way to mitigate them before the possible construction of the dam, the research question is posed. Is the economic value of the environmental impacts that would cause the construction of the hydroelectric dam in the Los Pescados River?

Methods and materials

Type of sampling and sample size

By means of a sampling by quotas, they were defined as upstream and downstream of the location of the reservoir to the locality of Tuzamapan and the municipality of Jalcomulco respectively. Following the steps to define the size of the quotas or sub-samples, Table 3 shows the size of each one. According to the sizes obtained from the quotas and in approximation to these, 18 people were interviewed in Jalcomulco and 42 in Tuzamapan[2].

Share	Location	Total of population [3] X_i	Weights $W_i = \frac{X_i}{\sum_{i=1}^{2} Xi}$ For i $= 1$ y 2	Precise installments
Upstream of the reservoir	Jalcomulco	2955	$W_1 = 0.28$	$C_1 = 17$
Downstream of the reservoir	Tuzamapan	7522	$W_2 = 0.72$	$C_2 = 43$

Table 3 Sample size by installments

It is important to mention that due to the type of sampling used, the results of the DAP and the DAC cannot be generalized to the total population belonging to each municipality, so the average of these two measures cannot be multiplied by the total population for globalize the results (Riera, 1994).

[2] Se decidió encuestar a $n = 60$ personas en total por razones de conveniencia, dejando en claro que este tamaño corresponde a una muestra piloto que puede ser empleada para estudios posteriores que den seguimiento a los resultados obtenidos de este estudio.

[3] El número de habitantes fue tomado de (SIALT, 2015) y corresponden a cifras del año 2010.

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So these will be presented individually. The questionnaire was designed to be answered by heads of households between 18 and 60 years of age, waiting for them to reveal both the DAP and the DAC for compensating or supporting environmental impacts respectively in a coherent manner.

Market simulation for the DAP

To investigate the economic value of environmental impacts, the equivalent variation in income (VE) was used as an ex ante monetary measure of the subjective change in the welfare of the inhabitants caused by the possible construction and operation activities of the dam. The valuation question was raised as the maximum provision to pay (DAP) for restoring the environmental impacts that the project would generate from the study of Alp and Yetis (2010), through this question the marginal change in the provision of the environmental goods and services in their quantity and quality given the current situation, as well as changes in the welfare of the users and non-users of the environmental goods and services that would bring about these modifications in the environment that, when monetized, would reflect their economic value partial.

The scale of measurement of the response that was used was binary: "yes or no", which according to Riera (1994) as part of the market simulation and trying to define the amount of what you want to value is done in terms of a proposed alternative that consists in maintaining the possible current state of affairs or accessing a change in this case. For those who answered "yes" to this question, they would immediately be questioned how they would like to help remediate environmental impacts; whether through work hours or through a regular contribution of money. Finally, for those who responded through a periodic contribution of money they would be thrown the valuation question in its continuous or open format.

Market simulation for the DAC

Like the WTP, the monetary measure of the subjective change in welfare by allowing the project to take place is the equivalent variation in income (VE). The people were asked if they would be willing to accept compensation for allowing the project to be carried out (DAP), the scale of measurement of this question is nominal and binary.

To the group of people who answered yes, they were immediately asked about the amount of money they would be willing to receive, this question was written in the open or continuous format. For the simulation of the frequency of the payment received, the weekly, bi-weekly, monthly and semi-annual options were considered. Later, they were asked about the person who should contribute the money, among which the government, emdam, or both were considered, and the option of someone else was left. Finally, the form of payment was raised as an open question to generate various options for future research.

Characteristics of the measuring instrument

The questionnaire consisted of a total of 37 questions which was designed to be answered in about 15 minutes each by the heads of households, this was divided into the following sections:

1. About the knowledge and perception of the project Purposes Múltiples Xalapa.
2. About the perception of the benefits of the project.
3. About the perception of project costs.
4. About the willingness to pay.
5. About the willingness to be compensated.
6. Socioeconomic information.

To describe the perception of the possible benefits and costs that the project could bring, the questions were designed and taken from the study of Sánchez and Verduzco (2015), these benefits and costs were hypothetically contextualized in a regional fashion. of positive and negative impacts, were raised so that they were directly related to the person interviewed as an important social actor involved in the project.

The logistic regression model and its application for the calculation of the WTP in the context of the MVC

The question about the willingness to pay corresponds to the binary format, which requires in its analysis as a response variable the use of the Logistic Regression Model by its scale of measurement, which is specified as follows:

$$Y^* = P_i = \frac{1}{1 + e^{-(V_i - V_j)}} = \frac{1}{1 + e^{-Z_i}} \quad (1)$$

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Where

$P_i =$ Probability that a person is willing to contribute to the restoration of environmental impacts, by axiom assumes the values between 0 and 1, where the random variable dependent and binary Y^* assumes the following values: $0 =$ Not willing and 1 = If you are willing.
$Z_i = (V_i - V_j)$ is the linear predictor obtained from the condition of indifference between indirect and random utilities vi, vj that allows obtaining the maximum provision to pay for the restoration of environmental impacts, this can present the following range of variation without limits that goes from -∞ a ∞, the relationship between Pi and Zi is non-linear.

For the present study and according to the design of the questionnaire to comply with the objectives, the person will be willing to contribute to the restoration of the environmental impacts in case the project is carried out, if:

$$V_i = v_i(B, C, S, M - t;\ E_0) + u_i \geq V_j = v_j(B, C, S, M;\ E_0) + u_j \quad (2)$$

Where:
$v_i =$ Indirect utility function if the project is carried out.
B = Perception about the benefits that would bring with it to carry out the construction of the dam and hydroelectric power station.
$C =$ Perception about the costs that would bring with it to carry out the construction of the dam and hydroelectric power station.
$S =$ Socioeconomic characteristics.
M = Level of monetary income of the individual.
t = Amount of money that the individual would forgo to help restore environmental impacts if the project were carried out.
$E_0 =$ Prevailing environmental conditions
u = Random component of the utility functions.

Therefore, the probability that a person is willing to contribute to restoring environmental impacts means that the indifference condition or the inequality of the previous utilities can be simplified in the following way:

$$v_i(B, C, S, M - t; E_0) - v_j(B, C, S, M; E_0) \geq u_j - u_i \quad (3)$$

As mentioned by Valdivia, Cuevas, Sandoval and Romo (2009), the probability that the interviewed individual will respond affirmatively to the question about willingness to pay is equal to the probability that the previous condition will be met. If the left member of the inequality reduces the parameters that would be obtained from its estimate, leaving aside E_0 and assuming that:

$$v_i(B, C, S, M - t) = \theta_i + \alpha B + \beta C + \gamma S + \pi(M - t) \quad (4)$$

This is a test to add the new formula

$$v_i(B, C, S, M - t) = \theta_i + \alpha B + \beta C + \gamma S + \pi M \quad (5)$$

Then:

$$v_i(B, C, S, M - t) = \theta_i + \alpha B + \beta C + \gamma S + \pi M \quad (6)$$

$$v_i(B, C, S, M - t) = \theta_i + \alpha B + \beta C + \gamma S + \pi M \quad (7)$$

Then:

$$v_i - v_j = \theta_i + \alpha B + \beta C + \gamma S + \pi(M - t) - \theta_j - \alpha B - \beta C - \gamma S - \pi M \quad (8)$$

$$v_i - v_j = (\theta_i - \theta_j) + \pi t \quad (9)$$

Therefore, the probability that a person is willing to contribute to the restoration of environmental impacts under the logistic regression model can be rewritten as:

$$P(Y^* = 1) = \frac{1}{1 + e^{-(V_i - V_j)}} = \frac{1}{1 + e^{-((\theta_i - \theta_j) + \pi t)}} \quad (10)$$

According to the properties of the cumulative logistics distribution, the following cases are:

a. $P \to 1$ when $Z = (V_i - V_j) \to \infty$, implies that, as $v_i - v_j = (\theta_i - \theta_j) + \pi t$, t being the maximum amount of money that the person would be willing to pay (DAP) to restore environmental impacts, given that this is based on the level of income, the higher the income level of individuals, the higher their DAP or the value of t, and therefore the probability that the person is willing to contribute to compensate the environmental impacts will be closer to 1.

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b. $P \to 0$ when $Z = (V_i - V_j) \to -\infty$, implies that, as $v_i - v_j = (\theta_i - \theta_j) + \pi t$, since t represents the value of the WTP and it is based on the level of income, the smaller the level of income of the people, the value of t or the WTP will also be lower and, along with it, the probability that the person is willing to contribute to redress the environmental impacts will be closer a 0.

Results

Maximum Disposition to Pay (DAP) for restoring the possible Environmental Impacts caused by the construction and operation of the dam and hydroelectric power station.

Taken from the study by Alp and Yetis (2010) the assessment question was adapted and applied as follows:

"It will be very difficult and costly to repair the environmental damage caused by the project, so that the contributions of the people of the area could be necessary to help restore the local environment that will be damaged by the project, would you be willing to contribute to a local effort that would include everyone in the region?"

To which in Jalcomulco nobody was willing to contribute, in the case of Tuzamapan, 33% of the inhabitants interviewed declared that they were willing to participate in a local effort that would include them all in the region to compensate for the environmental impacts. According to the results of the survey, the majority of these people were independent women with a bachelor's degree, most of whom responded to receive 4000 pesos of monthly income. This group was immediately asked how they would like to help redress environmental impacts, if:

a. Through hours of work in the reconstruction or.
b. Through a periodic contribution of money.

To which all mentioned that, through working hours, nobody agreed to contribute a periodic amount of money.

Among the reasons why people are not willing to contribute to the restoration of environmental impacts in the case of Jalcomulco, 50% of the people interviewed felt that it is the emdam's responsibility to restore environmental impacts, while 39% They think it's the government's responsibility. In the case of Tuzamapan, 36% of the people interviewed felt that the main reason why they would not contribute to the reconstruction of environmental impacts is because it is not the responsibility of the people, as well as 38% believe that it is the responsibility of the emdam restore environmental impacts.

Even though it was not possible to find a DAP different from zero that would reflect the economic value of the environmental impacts that the construction and operation of the dam and hydroelectric power station could cause and that could therefore be added to the environmental costs that the project would originate in the analysis cost-benefit, it could be observed that there is a willingness to contribute to redress the environmental impacts through working hours in the reconstruction of these.

Logistic regression model about the willingness to contribute to the reconstruction of environmental impacts through work hours

Table 4 shows the variables used in the logistic regression model which aims to estimate the probability that a person belonging to the communities of Jalcomulco or Tuzamapan is willing to contribute to the restoration of environmental impacts through working hours. in case of carrying out the project of construction and operation of the dam.

Variable Dependent Dap_3 (probability that a person is willing to contribute to compensate the environmental impacts through working hours); 0 = not willing, 1 = if you are willing		
Independent variables	**Definition**	**Units / Scale**
Proym_3	Perception of the environmental impact caused by the physical characteristics of the dam.	0 = low 1 = medium 2 = high 3 = very high
Cost_7	Knowledge about the endemic species of fauna at risk of extinction.	0 = No 1 = Yes
Ocup	Current occupation.	0 = housewife 1 = employee 2 = std 3 = independent

Table 4 Variables of the model, definition and units of scale to estimate the DAP.

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Table 5 shows the results of the model obtained with the help of the STATA 12 program.

Dependent Variable: Dap 3 (probability that a person is willing to contribute to compensate environmental impacts through working hours) 0 = not willing, 1 = if willing.		
Independent variables	**Coefficient**	**Standard error**
Proym_3	-1.304602	0.6319548
Cost_7	-1.675712	0.7852371
Ocup	0.605968	0.2677484
Constant	1.200605	1.261659

Table 5. Analysis of the results by maximum likelihood

According to the signs of the coefficients, a change in the occupation of people when going from 0 (from housewife) to 1 (used) increases the probability of response. While the knowledge about the possible extinction of endemic species (Cost_7) contributes negatively to the probability of response when going from 0 (does not have knowledge) to 1 (if it has knowledge). Similarly, the variable about the perception of environmental impact by people contributes negatively to the probability of response as the perception of environmental impact becomes higher. Table 6 shows the results of the Wald test of individual significance for the independent variables obtained after the estimation.

Coefficient	**Degrees of freedom**	**Chi square of Wald**	**Pr> Chi square of Wald**
Proym_3	1	4.26	0.0390
Cost_7	1	4.55	0.0328
Ocup	1	5.12	0.0236

Table 6. Wald test of individual significance

According to the Wald test, the three variables are statistically significant, that is, if they explain individually the probability that a person is willing to contribute to compensate for environmental impacts through the provision of work hours. Similarly, the global significance test that the variables together explain the probability of response turned out to be significant, the test statistic Chi square with 3 degrees of freedom was equal to 22.69.

As a measure of the goodness of fit of the model, table 7 shows the percentage of correct forecasts, taking into account that a probability greater than or equal to 0.5 is considered equal to 1, that is, the person is willing to contribute to compensate environmental impacts through working hours and when it is less than 0.5 that the person is not willing.

Classification	**Total**
$Pr(Dap\_3) >= 0.5$	18
$Pr(Dap_3) < 0.5$	42
Total	60

Table 7 Percentages of model forecasts as a measure of goodness of fit

According to the twenty people in the sample who, if they are willing to contribute to the restoration of environmental impacts through work hours, the model predicts 18 results, in this sense the model predicts about 90% of the correct forecasts. However, the Pseudo R2 is only equal to 0.2970 which is a bit low. Table 8 shows some of the scenarios that explain the probability that a person is willing to contribute to the restoration of environmental impacts through working hours, these scenarios are designed through the observation and control of the partial effects of the variables obtained with the help of the STATA 12 program.

Pr(Dap_3 =1) =0.1964552		
Coefficients	**Values**	**Partial effects dy / dx**
Proym_3	2	-0.2787878
Cost_7	0	-0.1526961
Ocup	0	0.0956658

Table 8. Partial effects and probability that a housewife is willing to contribute to compensate for environmental impacts through work hours

This scenario predicts that the probability that a housewife who perceives "as very high" the environmental impacts that the hydroelectric dam would generate and that has no knowledge about the possible extinction of endemic species is low, contributes to the restoration of environmental impacts. equal to 0.1964. However, as the following scenario shows in the case of students, the probability is greater.

Pr(Dap_3 =1) =0.45099247		
Coefficients	**Values**	**Partial effects dy / dx**
Proym_3	2	-0.3230171
Cost_7	0	-0.3177251
Ocup	2	0.1500367

Table 9. Partial effects and probability that a student is willing to contribute to compensate for environmental impacts through work hours

As can be seen in table 9, the probability that a student who perceives "as very high" the environmental impacts that the hydroelectric dam would generate and that has no knowledge about the possible extinction of endemic species will contribute to the restoration of environmental impacts. Is 0.4509 higher, this result is corroborated by the positive sign of the coefficient.

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Willingness to accept compensation (DAC) for supporting the effects of the possible environmental impacts of the project

The question about accepting a minimum amount of money (DAC) so as not to reject the project and support the environmental impacts, was formulated in the following way: Would you be willing to receive compensation to accept that the project is carried out? To which in Jalcomulco the total of the surveyed population answered flatly that no, this was a response of protest. While in Tuzamapan 17% of the surveyed population (7 people) said yes; by occupation corresponds to 3 employees, 2 students and 2 independent, by academic degree only two people claimed to have a bachelor's degree and the rest only high school. These people were immediately asked for a minimum amount of money they would be willing to receive, as part of the market simulation the questionnaire was given the option to choose between a weekly, biweekly, monthly and semi-annual frequency. Table 10 shows some of the descriptive statistics of the DAC.

Minimum	Maximum	Rank	Average	Standard deviation
16,000.00	80,000.00	64,000.00	42,857.14	9,789.28

Table 10 Descriptive statistics of the monthly DAC in Tuzamapan

The descriptive results of Table 10 show an average monthly DAC per household equal to 42857.14 pesos; with a range of large variation and an equal standard deviation of 9789.28 pesos, this measure is not representative of the population of Tuzamapan, however it can be used as a reference to establish guide prices in future research (Riera, 1994). As part of the market simulation, people were asked how they would like to receive this money (the payment vehicle) as an open question, to which most of the people declared a deposit to a bank account using a Saving card would be the best way to receive the money. In relation to those who should contribute the monthly money, most think that both the government and the emdam in charge of carrying out the project should be.

To observe the meaning of the partial effects, table 11 shows the variables used and the results of the logistic regression model that explain the probability that a person is willing to accept a minimum compensation of money to support the environmental impacts of the project.

Dependent variable: DAC (probability that a person is willing to accept a minimum amount of money for supporting the environmental impacts of the project); 0 = not available, 1 = if available.		
Independent variables	**Definition**	**Units / Scale**
Benef_7	Willingness to participate in temporary employment under a training program and favorable working conditions	0 = not willing 1 = yes it is willing
Esc	Level of education	0 = Primary 1 = Sequential 2 = Baccalaureate 3 = Degree

Table 11 Variables of the model, definition and units of the scale to estimate the DAC

Dependent variable: DAC (probability that a person is willing to accept a minimum amount of money to support the environmental impacts of the project); 0 = not available, 1 = if available.		
Independent variables	**Coefficient**	**Standard error**
Benef_7	4.3683	1.6272
Esc	2.2135	1.0684
Constante	-7.8623	2.9600

Table 12 Analysis of the results by maximum likelihood.

According to Table 12, the sign of the coefficients, a change in the perception of individuals going from being unwilling to be willing to participate in a temporary employment program is positively associated with the probability of response to accept compensation to support the environmental impacts, the same happens with the level of schooling; since this is an ordinal variable, it can be said that the higher the level of schooling, the greater the probability of response of accepting compensation to support environmental impacts. Table 13 shows the results of the Wald test of individual significance for the independent variables obtained after the estimation.

Coefficient	**Degrees of freedom**	**Chi square of Wald**	**Pr> Chi square of Wald**
Benef_7	1	7.21	0.0073
Esc	1	4.29	0.0383

Table 13 Wald test of individual significance

According to the Wald test, the two variables are statistically significant, that is, if they explain individually the probability that a person is willing to accept compensation. Similarly, the global significance test that the variables together explain the response probability turned out to be significant, the Chi square test statistic with 2 degrees of freedom was equal to 0.000.

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Conclusions and recommendations

The general objective of this work was to estimate the partial economic value of the possible environmental impacts that would be generated by the construction and operation of the dam and hydroelectric power station on the Los Pescados River in the La Antigua river basin as part of the Xalares-Xapida project. of the contingent valuation method for heads of households in the municipalities of Jalcomulco and Tuzmapan from a quota sampling.

These assessments focused on estimating the WTP to restore the possible environmental impacts that would originate the project and the DAC to be willing to support them. The results of the survey show that in monetary terms it was not possible to estimate them in the municipality of Jalcomulco, since the answers were equal to zero in the case of the DAP and in the DAC there was no willingness to accept compensation, most of the population surveyed in this municipality thinks that it is the responsibility and obligation of the emdam to restore the environment that will be affected by the project. In the case of Tuzamapan even though it was not possible to estimate the WTP in monetary terms, a part of the population declared that it was willing to contribute to the restoration of the possible environmental impacts that the project would originate through working hours in a collective effort that will include everyone in the region.

Even though the design of the questionnaire did not allow us to delve further into quantifying a possible workday for the restoration of environmental impacts, the results of the survey allowed us to calculate the probability that a person (or a head of household) belonging to one of the municipalities be willing to do it; among the most important characteristics associated in a significant way according to the Wald test and that explain this probability are: the perception of the risk of environmental impacts by the physical characteristics of the dam, the knowledge of the people about the possible extinction of endemic species belonging to marine fauna together with the different occupations and jobs of the inhabitants.

To say about this; the greater the degree of schooling, the greater the probability of response, in the case of the perception of the risk of environmental impacts; the higher and more severe the perception is, the lower the probability, and finally, according to the model, a person is more likely to contribute to compensate for environmental impacts when he or she is unaware of the extinction of endemic species than when he or she has it..

In this sense, even though the second objective could not be reached: to quantify the WTP in monetary terms to incorporate it into the cost-benefit analysis of the project, some prospective scenarios could be obtained that explain the probability that a person belonging to one of the municipalities of Jalcomulco or Tuzamapan is willing to contribute to compensate for environmental impacts through working hours, which can help to build socially acceptable mitigation-impact strategies, at the same time serves as a reference for future studies that can incorporate the number of hours arranged to work for a certain time and the equivalent remunerations as a quantifiable approximation of the DAP.

In the case of the DAC this turned out to be $ 4,2857.14 pesos per month per household, given that its standard deviation is high and it is not a measure obtained from a representative sample of the population of Tuzamapan, it can only be used for establish future guide prices in future research. Among the most important factors that explain the DAC are the willingness to participate in a temporary employment program as well as the academic degree, both in a positive way, which implies that people who are willing to participate in a temporary job will be more prone to accept compensation, in the same way the higher the degree, the greater the propensity to accept a minimum amount of money to support the environmental impacts that would originate the project.

This result reinforces the verification of the hypothesis that individuals are adverse to risk, ie; they value welfare losses more than the profits that the project benefits would originate, this translates into differences between the monetary value of the DAP and the DAC (Azqueta Oyarzun, 1998).

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On the other hand, among the strongest factors that explain the probability that a person is willing to accept compensation according to the Wald test of significance, are the level of schooling and willingness to participate in a temporary job, both in a positive way according to the results of the logistic regression model. The results of the work show the need to incorporate cost-benefit analysis into the environmental costs of the project in order to have a better quantification of impacts, on the other hand, the project cannot be carried out without the acceptance and participation of society.

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Guidelines for the manufacture of scaffolds used in tissue regeneration

Pautas para la fabricación de andamios utilizados en la regeneración de tejidos

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Abstract

Thanks to the need to discover alternative therapies to improve the functioning and function of body tissues, a multidisciplinary research area called Tissue Engineering (TE, Tissue Engineering) has emerged, which involves the use of supports or scaffolds manufactured with different materials that must be approved by the Food and Drugs Administration (FDA) and must be characterized, physically-chemically-biologically first, in vitro and if favorable results are obtained, they are used in biomodels in in vivo tests. This study shows the guidelines that should be considered for the manufacture of scaffolds or tissue scaffolds so that they can be the supports that allow the regeneration of tissues. Results of different scaffolds manufactured for Tissue Engineering are also shown.

Tissue scaffolds, Tissue regeneration, Scaffolds manufacturing

Resumen

Gracias a la necesidad de descubrir terapias alternativas para mejorar el funcionamiento y función de los tejidos corporales ha surgido un área multidisciplinar de investigación llamado Ingeniería Tisular (TE, *Tissue Engineering*), el cual involucra el uso de soportes o *scaffolds* manufacturados con diferentes materiales que deben estar aprobados por la Administración de Medicamentos y Alimentos (FDA, *Food and Drugs Administration*) y deben ser caracterizados, físico-quimico-biológicamente primeramente, in vitro y si se obtienen resultados favorables, son utilizados en biomodelos en ensayos *in vivo*. En este estudio se muestran las directrices que deben considerarse para la manufactura de *scaffolds* o andamios tisulares para que puedan ser los soportes que permitan la regeneración de tejidos. También se muestran resultados de diferentes *scaffolds* manufacturados para la Ingeniería Tisular.

Andamios tisulares, Regeneración de tejidos, Manufactura de scaffolds

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Introduction

The term Tissue Engineering (TE) was coined in the mid-80s by doctors Robert Langer and Joseph Vacanti (Langer & Vacanti, 1993). Integrates knowledge of cell biology, materials science, engineering, physics and mathematics; designing and building functional tissues that can be used for the maintenance, regeneration and replacement of damaged tissues (Kneser, Schaefer, Polykandriotis, & Horch, 2006).

The main elements that make up the TE are the supports or scaffolds, the cells and the growth factors. The scaffolds act as a vehicle to allow the migration and proliferation of cells so they must be manufactured from biocompatible materials to function as a temporary structure in which cells colonize to form new tissue (Fuchs, Nasseri, & Vacanti, 2001). The cells used in TE can be differentiated or undifferentiated (stem cells); the latter have the potential to divide and differentiate into any cell line for the regeneration of the type of tissue that wishes to regenerate. Growth factor are substances of protein origin that improve intercellular communication and stimulate regeneration processes.

For the manufacture of scaffolds or tissue scaffolds used for the regeneration of tissues, these must be biocompatible and biofunctional, so we start by choosing the material and manufacturing method that allows cells to be viable, adhere, migrate selectively and proliferate on the scaffold, so the following guidelines should be taken into account:

Structure: Must comply with structural requirements that mimic the tissue that you want to regenerate (Kutz, 2003).

Topography: The roughness is very important since experimentally it has been proven that if it presents a rough texture, it favors the adhesion and proliferation of the cells (Goodman, Sims, & Albrecht, 1996).

Hydrophilicity: It is related to the "wettability" of the system to allow the nutrients to interact in the scaffold and the waste can leave (Marí-Buyé et al., 2009).

Orientation: The orientation of the cells must be known as they proliferate and if they grow in a single-layer or multilayer manner.

Three-dimensionality: The fabrics are three-dimensional, so the scaffolds must have a height similar to that of the tissue (Selden et al., 1999). It has been shown that if there are differences in height, the cells find an adequate space to adhere and proliferate. The length that the scaffold must have depends on the space in which it will be implanted and the thickness should be as close as possible to the native tissue.

Porosity: Scaffolds must have porosity to allow cell colonization and the passage of fluids into cells, as well as the exit of waste (Ko, Milthorpe, & McFarland, 2007). It has been reported a favorable cellular adhesion and an increase in cellular proliferation between the pores (Wang et al., 2013).

Morphology: The shape of the scaffolds must be related to the application that will have according to the tissue to be regenerated so that it fits exactly in the space where it will be implanted (Peltola, Melchels, Grijpma, & Kellomäki, 2008).

Space: The area in which the scaffold will be implanted must be known to consider aspects such as the interaction between the support and the cells, the orientation of cell growth for tissue regeneration and blood supply (Flores-Cedillo et al., 2016).

Materials and methods

In this section, different manufactured scaffolds are analyzed in which considerations for their manufacture have been taken into account.

Structure: The structure of the scaffolds can be observed when using microscopy techniques. The scanning electron microscope is one of the alternatives mostly used for the analysis of the materials' miscrostructure. In the field of Tissue Engineering, it has high application.

Topography: For the topographical analysis can be used three-dimensional analysis techniques, in this article the use of Gwiddion® software is mentioned.

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Hydrophilicity: To measure the level of hydrophilicity of a PCL scaffold, the water drop method was used, which consists of placing a drop of water on the scaffold and magnifying it with a camera to later evaluate the angle generated between the drop and the scaffolding, thus defining the hydrophilicity level thereof.

Orientation: The orientation of the cells and tissues depends on the type of them. In this study, bone cells (osteoblasts) that have a characteristic elongated shape were observed with an inverted microscope.

Three-dimensionality: A manufactured scaffold was observed with a PCL biopolymer on which dental pulp stem cells were planted.

Porosity: The scanning electron microscope was used to observe the porosity of a manufactured polylactic acid (PLA) scaffold analyzing the pore size and the fibers.

Morphology: In this study, different polylactic acid and polycaprolactone scaffolds have been manufactured, which are biomaterials that are widely used in tissue regeneration due to their biocompatibility and biofunctionality. The form depends on the synthesis method and the space in which it is to be inserted.

Space: The implantation of a scaffold in the space suitable for tissue regeneration depends on all the previously mentioned characteristics so that it can be introduced in the space suitable for the tissue that wants to regenerate. A pair of scaffolds were introduced into bone defects of critical size (5 mm in diameter), on the skull of a Wistar rat used as a biomodel. One scaffold was manufactured with polycaprolactone and carbon nanotubes and the other with pure polycaprolactone.

Results and discussion

Structure: Figure 1 shows a micrograph of the structure of a scaffold manufactured with a polycaprolactone biopolymer (PCL) using a scanning electron microscope at a magnification of 2 μm in which the layers that confirm the microstructure of the biopolymer are notorious.

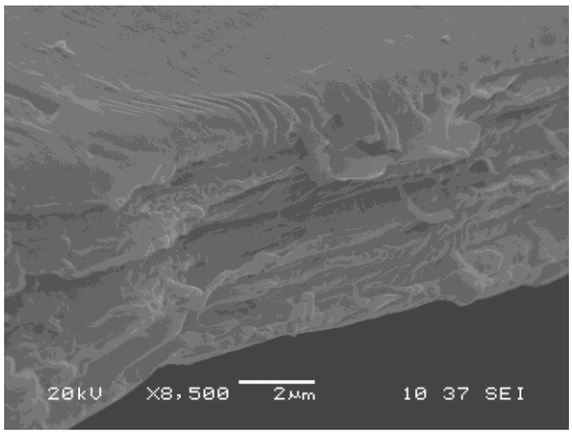

Figure 1 Polycaprolactone scaffold observed with a scanning electron microscope. (Scale: 2 μm)

Topography: In the micrography of Figure 2, the roughness level of the image is analyzed using the Gwiddion® software, observing the peaks of the texture and the ripple.

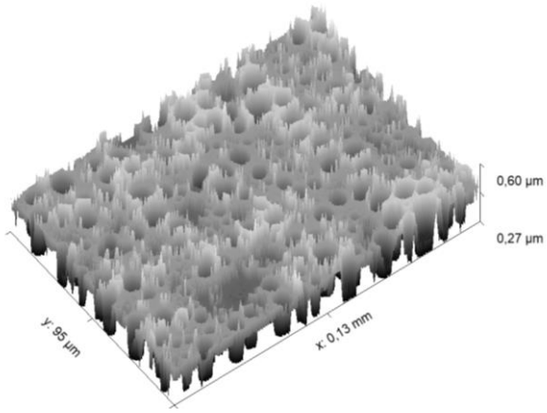

Figure 2 Polycaprolactone Scaffold observed with a scanning electron microscope and analyzing its topography (Software Gwyddion®)

Hydrophilicity: Figure 3 shows the technique to measure the level of hydrophilicity of a PCL scaffold using the water drop method, which consists of placing a drop of water on the scaffold and magnifying it using a camera to later evaluate the angle generated between the drop and the scaffold, thus defining the level of hydrophilicity thereof. In this case an angle of 70º was obtained, which indicates that it is partially hydrophilic, that is, it will allow the exchange of nutrients between the cells seeded in the scaffolding.

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Figure 3 Water drop method to measure the hydrophilicity of the scaffold

Orientation: Figure 4 shows the orientation of differentiated dental pulp stem cells in osteoblasts (bone cells) at 14 days of cell culture and observed in an inverted microscope.

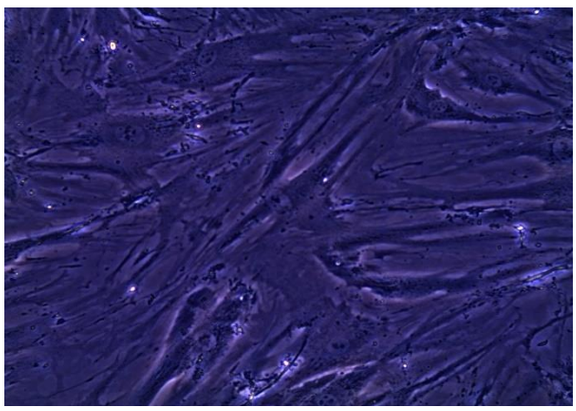

Figure 4 Orientation of the osteoblasts observed in the optical microscope

Tridimensionalidad: Three-dimensionality: Figure 5 shows the micrograph taken with the SEM on a scaffold manufactured with a PCL biopolymer and a dental pulp stem cell that is interwoven between the biopolymer.

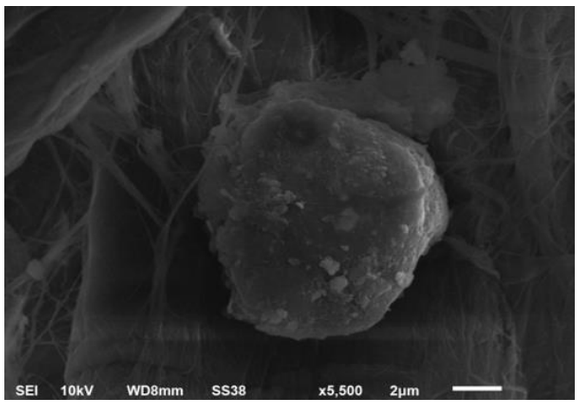

Figure 5 Micrograph of the scaffold manufactured with a biopolymer taken with the MEB (Amplification: 5,500X. Scale 2 µm)

Porosity: Figure 6 shows a micrograph taken with the MEB at an amplification of 50,000 and a scale of 0.5 µm. It is known that the average size of the different types of cells ranges between 10 and 100 µm. In this case the average pore size is 3 µm, that is, small for the cells to be embedded, but they can be modified to obtain an adequate pore size when manipulating parameters such as temperature and cooling speed during scaffold synthesis.

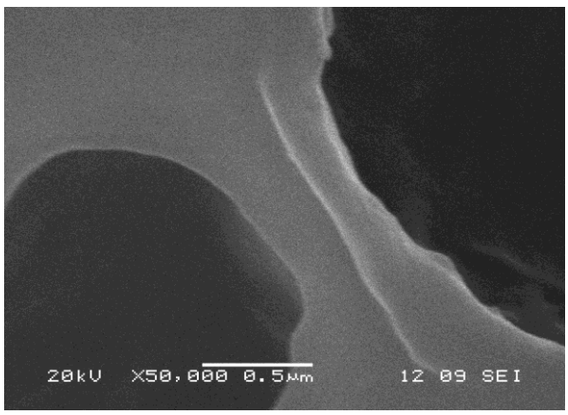

Figure 6 Micrograph of a scaffold manufactured with a biopolymer taken with the MEB. (Amplification: 50,000, scale: 0.5 µm)

Morphology: Figure 7 shows examples of scaffolds used in TE for the regeneration of different tissues reported by Reswan et al. (Rezwan, Chen, Blaker, & Boccaccini, 2006).

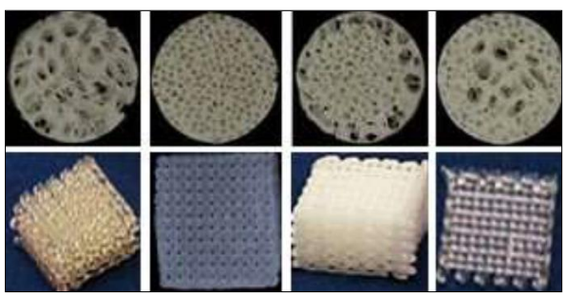

Figure 7 Examples of scaffolds used in Tissue Engineering.
Source: Rezwan et al.

Space: Figure 8 schematizes the implantation of a scaffold in the skull of a Wistar rat biomodel in the space suitable for the regeneration of bone tissue. The method of surgery has been evaluated and approved by a Bioethics Committee.

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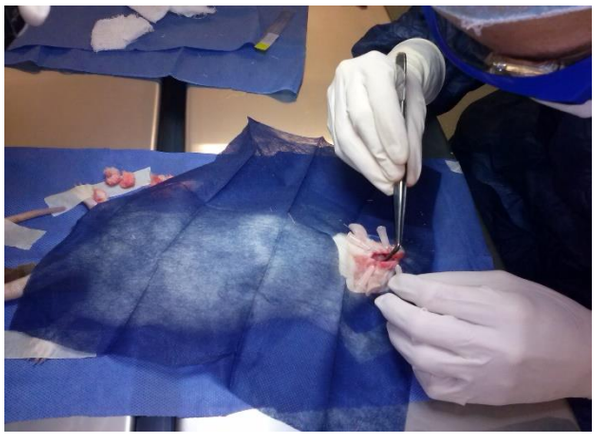

Figure 8 Surgery on biomodel for the evaluation of bone tissue regeneration

Conclusions

Tissue Engineering (TE) aims to develop biological substitutes that restore, maintain or improve the function of tissues, overcoming the limitations of conventional treatments. Therefore, there must be multiple considerations for the design and synthesis of the scaffolds depending on the type of tissue to be regenerated.

The type and characteristics of each tissue is as diverse as the technical considerations that should be taken in singing for the synthesis and manufacture of the scaffolds, which despite being considered as a temporary structure, should be evaluated exhaustively through in vitro characterization tests before its application on biomodels.

The main function of a scaffold is to allow the interaction between the cells, their viability, adhesion and cell proliferation; and, at times, it must be able to allow the differentiation of the cells by providing them with a favorable environment.

The field of TE is so diverse and currently many research groups are still looking for materials that can be used as scaffolds for the regeneration of tissues and their functions, so this study showed the main considerations of manufacturing that should continue to value both in vitro as in vivo using biomodels that resemble the human organism.

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Preparation and implementation of a manual of Good Poultry Practices in a bird incubator plant in the central area of the state of Veracruz

Elaboración e implementación de un manual de Buenas Prácticas Avícolas en una planta incubadora de aves de la zona centro del estado de Veracruz

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Abstract

The objective of this research is to demonstrate that the preparation and implementation of a manual of Good Poultry Practices in a bird incubator plant in the central area of the State of Veracruz, reduces the risks of physical, chemical and bacteriological contamination during the entire process productive, to obtain safe and quality products. It began with an evaluation of the facilities and processes that are carried out in the plant. The Good Poultry Practices Manual is a tool that consists of twelve chapters with their documented procedures to record the activities that take place in the plant to have a correct control in the operations of the plant. It also describes the recommendations regarding infrastructure, management, safety measures and animal welfare that must be met according to SENASICA (National Service of Health, Safety and Agri-food Quality), SAGARPA (Secretary of Agriculture, Livestock, Rural Development, Fisheries and Food.) and the Official Mexican Standards which support this investigation.

Standardize, Quality, Process, Safety

Resumen

El objetivo de esta investigación es demostrar que la elaboración e implementación de un manual de Buenas Prácticas Avícolas en una planta incubadora de aves de la zona centro del Estado de Veracruz, reduce los riesgos de contaminación de tipo físico, químico y bacteriológico durante todo el proceso productivo, para obtener productos inocuos y de calidad. Se inició con una evaluación de las instalaciones y procesos que se realizan en la planta. El manual de Buenas de Prácticas Avícolas es una herramienta que consta de doce capítulos con sus procedimientos documentados para realizar registros de las actividades que se desarrollen en la planta para tener un correcto control en las operaciones de la misma. También se describen las recomendaciones en cuanto a infraestructura, manejos, medidas de seguridad y bienestar animal que se deben cumplir de acuerdo a SENASICA (Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria), SAGARPA (Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación.) y las Normas Oficiales Mexicanas las cuales sustentan esta investigación.

Estandarizar, Calidad, Proceso, Inocuidad

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Introduction

The Good Manufacturing Practices (GMP) were promulgated by the Food and Drug Administration (FDA) to provide criteria for compliance with the provisions of the Federal Food, Drug and Cosmestic that order that all foods of human consumption must be exempt from adulteration. Special emphasis is placed on the prevention of contamination of products from direct and indirect sources. Sanitary regulations promulgated by the US Department of Agriculture (USDA) contain identical or similar requirements. (Marriot, 2003)

These are regulations that describe the methods, facilities or controls required to ensure that the food has been processed, prepared, packaged and maintained in good sanitary conditions. According to (Inppaz 2003), an adequate GMP program will include procedures related to:

- Management of the facilities.
- Reception and storage.
- Transportation.
- Equipment maintenance.
- Personnel training and hygiene.
- Pest control.
- Traceability.

The manual of good poultry practices describes the procedures that must be performed and documented within the incubator plant to maintain adequate safety conditions, in addition to pointing out the sanitation rules that must be followed from the reception of the hatching egg until the exit of the chick. for fattening.

A flow diagram of the production process was carried out, starting from the reception of the incubatable egg and culminating with the delivery of the fattening chick to the different farms for breeding, with the aim of standardizing the process and identifying the critical control points.

In the Good Practices it is necessary to keep a program of records about the process and the activities that are carried out during the process. (Ledezma 2003).

Justification

The preparation and implementation of a manual of good poultry practices is a tool that will allow the bird incubator to standardize its processes and control the production, in addition to ensuring the biosecurity of the place and animal welfare, and may increase the production of first quality chicks and reduce the risks of physical, chemical and bacteriological contamination throughout the production process.

Problem

The incubator plant for birds of the central zone of the State of Veracruz does not have tools that allow it to guarantee the quality and innocuousness in the production of fattening chicks.

Objectives

General objective

Prepare a Manual of Good Poultry Practices to standardize the processes that are carried out in the different areas of the bird incubator plant.

Specific objectives

- Implement good poultry practices in the bird incubator plant to ensure food safety, animal welfare, worker safety and environmental protection.

- Provide the person in charge of the plant with records of the activities carried out in the plant to have a correct control in the operations of the same.

Theoretical framework

The egg that is produced to be incubated must meet certain conditions, which must be respected in order to achieve the maximum incubation performance, which will result in obtaining a greater number of chicks with respect to a given number of eggs.

The egg: is formed by the following parts; shell, cascaragenous membranes, clear, air chamber, chalazas, yolk membrane and yolk.

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The incubator plants are responsible for maintaining this type of eggs under the best possible conditions to obtain chicks of first quality, it should be mentioned that this amount expressed as a percentage of all eggs laid for incubation is usually called birth. (Aviagen, 2008).

The quality of the chick and the optimum hatchability can only be reached when the egg is placed under optimum conditions between the posture and the incubator load. A fertile egg contains many living cells. Once the egg is laid, its birth potential can be maintained but not improved. But if this is mishandled, the birth potential will deteriorate rapidly. (Vasquez, 2008).

Castellanos (2004) makes mention that the application of GMP allows to control the operational conditions within an establishment. This program includes procedures related to the sanitary-hygienic conditions of the establishments, reception, storage, maintenance of equipment, personnel training and hygiene, pest control, cleaning and disinfection.

Biosecurity in this type of facility constitutes the basis for achieving the conditions of animal safety and welfare. Incubation is the main basis for chick quality, requiring optimal conditions for embryo growth and development (Alfonso 2013). The implementation of registries in this type of establishments guarantee the quality and innocuousness to the consumer. (Briz 2004).

Methodology

The work was developed in an incubator plant for birds of the central zone of the State of Veracruz, in a period of six months. It is a qualitative research which was carried out in four stages:

Stage 1 Data collection and analysis: During the data collection for the preparation of the poultry Good Practices manual for the Incubator Plant it is obtained that the main causes of the deficit in the percentage of births of first quality chicks are:

1. Lack of maintenance to the facilities.
2. Lack of staff training.
3. There is no standardization in production.
4. Process hygiene is not guaranteed.
5. The records that exist are very scarce.

Stage 2 Elaboration of the Manual: Based on the findings found in stage 1, it begins with the preparation of the manual of poultry Good Practices for the Incubator Plant.

Stage 3 Process standardization: All the activities carried out in each stage of the process were described and documented by means of registers, using formats to follow up on the recommendations of SENASICA (National Service for Agrifood Health, Safety and Quality) and SAGARPA (Secretary of Agriculture, Livestock, Rural Development, Fishing and Food.)

Stage 4 Implementation: During the implementation the following limitations were found:

– Because there are deficiencies in the maintenance of the facilities, a capital investment is required.

– Availability of the head of the incubator plant for compliance with the Good Practices, following up on the records and activities that were initiated for compliance with these.

Results

The bird incubator plant already has a manual of good poultry practices that consists of twelve chapters, as described in table 1.

Structure of the good practice manual	
Chapter No.	Name
Chapter 1	Location
Chapter 2	Infrastructure and facilities
Chapter 3.	Revenue control
Chapter 4.	Handling of incubatable egg
Chapter 5.	Cleaning and disinfection
Chapter 6	Pest control
Chapter 7	Animal welfare
Chapter 8	Maintenance
Chapter 9	Critical control points during the process of the fattening chick
Chapter 10	Records
Chapter 11	Preparation of procedures that are carried out in the incubator plant
Chapter 12	Temperature control of incubatable egg

Table 1 Structure of the manual of Good Poultry Practices

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To have a control in the standardization of the processes, the following record formats were designed:

Format 1 Lighting levels
Format 2 Sanitary Cleaning Record
Format 3 Correct hand washing
Format 4 Visit log
Format 5 Vehicle registration
Format 6 Staff training
Format 7 Cleaning control in incubator plant
Format 8 Pest control
Format 9 Maintenance records
Format 10 Maintenance of hatchers
Format 11 Incubator maintenance
Format 12 Records during the incubation process.
Format 13 Control of loads to the incubator
Format 14 Registration for embryo diagnostics
Format 15 Chick sent report

During the development and implementation of the manual of good poultry practices in which the following areas of opportunity for the bird incubator plant were found:

1. Adapt a parking lot in the front for vehicles.
2. Acquire vehicles with controlled temperature to collect the egg and transport the chick one day.
3. Install a disinfection bow on the back. To disinfect all the units that enter to avoid contamination in the incubator plant.
4. Improve the air circulation system in the preheating room to avoid a disparity in egg temperatures.
5. Train staff of the incubator plant regarding hygiene and biosecurity practices,
6. Change personnel protection equipment in accordance with Official Mexican Standard NOM-017-STPS-2008. To provide safety to personnel.
7. Operators must dispose and use the required elements when necessary, such as coveralls, goggles, helmets, protective gloves, boots, etc.
8. Install sinks in the different production areas (cold room, incubators, hatchers, chicken room).
9. Waterproof roofing to avoid the presence of water leaks.
10. Restore the cracks that appear in floors and walls to avoid the presence of bacteria.

Conclusions

In order to obtain safe and quality products it is important that the bird incubator plant has a certification in quality management systems before SENASICA (National Service of Health, Safety and Agri-Food Quality) and SAGARPA (Secretary of Agriculture, Livestock, Rural Development, Fishing and Food.), It is also important that the plant correctly implement the manual of good poultry practices, to enter a globalized market.

Acknowledgement

We thank the Higher Technological Institute of Huatusco and the incubator plant for birds of the central zone of the state of Veracruz.

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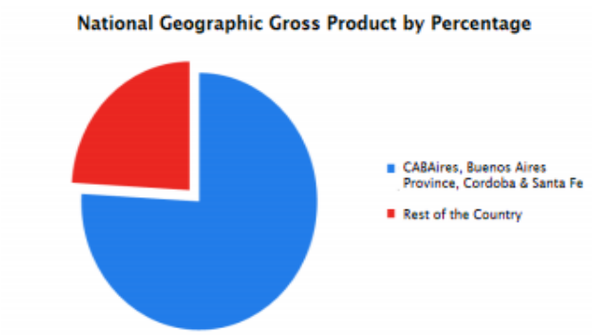

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