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Support the international scientific community in its written production Science, Technology and Innovation in the Field of Agricultural Sciences and Biotechnology, in Subdisciplines of Agriculture: Aggregate Supply and demand analysis, Prices, Micro analysis of farm firms, Farm households, and farm input markets, Agricultural markets and marketing, Cooperatives, Agribusiness, Agricultural finance, Land ownership and tenure, Land reform, Land use, Irrigation, R&D, Agricultural technology, Agricultural extension services, Agriculture in international trade, Agricultural policy, Food policy; Renewable resources and conservation: Environmental management, Demand and supply, Environmental modeling and forecasting firm behavior institutions, Illegal behavior, Fishery, Forestry, Land, Water, Air, Climate, Noise, Recreational Aspects of natural resources, Contingent valuation methods; Nonrenewable resources and conservation: Demand and supply, Exhaustible resources and economic development, Resource booms; Energy: Demand and supply, Alternative energy sources, Energy and the macroeconomy.

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Presentation of the Content

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Management of urban solid waste in Mexico

Gestión de los residuos sólidos urbanos en México

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Abstract

The waste generated at the global level have increased significantly with the passage of the years, this due to the level of industrialization of each country as well as by globalization, which together directly impact on consumption is done from various products that cover the basic and recreational needs. This sustained increase, implies a greater volume and diversity of composition of the solid waste generated around the world, however, in particular, the main objective of this article is to make known the management of urban solid waste in Mexico, its characterization, regulation and the necessary regulations that permit the correct management of these wastes. Also the key components to carry out an efficient management of urban solid waste, considering various actions or activities including the generation of waste, collection, transfer, the use and final disposition are described. In addition, statics about recycling and utilization of urban solid waste are shown.

Management, Urban solid waste, Mexico

Resumen

Los residuos que se generan a nivel mundial se han incrementado significativamente con el paso de los años, esto debido al nivel de industrialización de cada país así como por la globalización, que en conjunto impactan directamente en el consumo que se realiza de diversos productos que cubren las necesidades básicas y de esparcimiento. Este aumento sostenido, implica un mayor volumen y diversidad de composición de los residuos sólidos que se generan, en particular este artículo tiene como objetivo general dar a conocer la gestión de los residuos sólidos urbanos que se realiza en México así como su caracterización y regulación, incluyendo además, la normativa necesaria que permita realizar la correcta administración de estos residuos. Se describen los componentes clave que se requieren para llevar a cabo una eficiente gestión de los residuos sólidos urbanos, considerando diversas acciones o actividades entre las cuales se encuentran listadas la generación de residuos, su recolección, la transferencia, el aprovechamiento y la disposición final. Además, se muestran cifras acerca del reciclaje y aprovechamiento de los residuos sólidos urbanos.

Gestión, Residuos sólidos urbanos, México

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Introduction

Over the years, the generation of waste has grown enormously due to economic development, industrialization and the implementation of Economic models (Naredo, 1994), which together imply a sustained increase in consumption in the diversity of products that exist, impacted significantly in the volume and composition of solid waste (SW) produced in the world and in Mexico (SEMARNAT, 2015).

The classification of these SRs is given by the source that generates the waste, so they can be domiciliary, commercial, hospital, public spaces, institutional and industrial. On the other hand, the general waste law mentions that urban solid waste (USW) are those produced in houses, offices or streets, special handling waste generated in some non-hazardous production processes and by large generators, and hazardous waste. , with characteristics of risk (SEMARNAT, 2015), being calculated by the Ministry of Social Development (SEDESOL) in accordance with the provisions of the standard NMX-AA-61-1985 on the Determination of the Generation of Solid Waste (NOM, 1985).

According to the General Law for the Prevention and Integral Management of Residues (LGPGIR), USW is considered more particularly "those generated in housing, resulting from the elimination of materials used in domestic activities, the products that are consumed and their packaging, packaging or packaging; the waste that comes from any other activity inside establishments or in the public road that generates waste with domiciliary characteristics, and the resulting ones of the cleaning of the routes and public places, whenever they are not considered by this Law as waste of another nature " (PROFEPA, 2016).

The management of the USW is considered one of the most neglected areas in urban development because, in general, in Mexico the lack of economic resources and inadequate planning, makes it difficult to properly carry out the management of the USW (Taboada et al, 2014), leaving aside extremely important information and making sustainable management means necessary (Mwanza y Mbohwa, 2017).

Therefore, for proper waste management, it is necessary to duly comply with the guidelines and activities that comprise it, which include the generation, collection and sweeping, transfer, use and final disposal of waste, according to the Official Standard Mexican NOM-083-SEMARNAT-2003 (DOF, 2004). Currently in Mexico, it is sought to increase the recycling of USW, based on public policies and the development of national technology.

This document focuses on publicizing the management of urban solid waste in Mexico and its characterization, including in it the necessary regulations to perform the proper management of this waste.

Background

To understand the management of the USW, it is necessary to have knowledge of the background corresponding to what has been shown in this document "Solid waste management in Mexico goes through three moments in its history: it began in 1964 under a predominantly sanitary regulation, later in 1988, after the creation of the national environmental legislation, a step towards the basic management of waste is taken, the last change in 2003 is due to the creation of the General Law for the Prevention and Integral Management of Waste " (Calva-Alejo y Rojas-Calderas, 2014).

In October 2004, the first Solid Waste Integral Management Program (PGIRS) 2004-2008 was published in the Official Gazette of the Federal District for Mexico City today, being the first document of its kind nationwide. (GODF, 2004). With the establishment of this program is that the separation of waste is established and it is proposed to align the scheme of provision of the service of cleaning and waste management (SEDEMA, 2016).

The Integral Management of Urban Solid Waste, is basically the choice and application of multiple techniques, technologies and management programs analyzed to be suitable in the scope of specific objectives in waste management, where it is managed to reduce, reuse, recycle, transformation and dumping.

It also contemplates the administration of functional elements such as generation, handling, collection, separation, processing, transformation, transfer, transport, landfill and recovery of landfill postclosure (Márquez-Benavides, 2011).

Later in Mexico, the LGPGIR was enacted since 2006, which establishes that it is the faculty of the regular federation on waste. (PROFEPA, 2016). The LGPGIR also establishes that the federal environmental authority must promote, together with the state and municipal governments, the participation of investors and the social sector; as well as the research, development and application of new technologies, equipment, systems and processes that eliminate, reduce or minimize environmental pollution by the integral management of waste; At the same time, control measures, financial incentives, financial and market incentives are imposed to prevent or avoid the generation of waste, as well as sanctions for non-compliance with regulations. For this, the official Mexican standards (NOM) were issued to carry out the integral management of the USW, of special and dangerous handling. According to this law, the states must submit to the Secretary of Environment and Resources (SEMARNAT) the construction and operation of sanitary landfills to receive technical assistance from the Federal Government for this purpose and the collection for the integral management of the USW.

Regulation

With the increase of industrialization and generation of products in the whole world, processes are being implemented to take advantage of the USW in Mexico, recovering paper, cardboard, textiles, metals, plastic and glass with the purpose of being recycled and reused after an industrial process and consumption. This type of processes as well as the use of the resulting materials are regulated by laws and regulations established by the Federal Government, in charge of elaborating the applicable legal and institutional framework for the management of the USW, which are reflected for example in the General Law of the Ecological Balance and the Protection of the Environment (CDHCU, 2018), the Law for the Prevention and Integral Management of Wastes (PROFEPA, 2016) or the standard NMX-AA-61-1985 on the Determination of the Generation of Solid Residues (NOM, 1985).

This document characterizes only the USW which are the responsibility of the municipality, being separated from the special handling waste (RME), which are of state competence; and hazardous waste (RP), federal competition (PROFEPA, 2016)

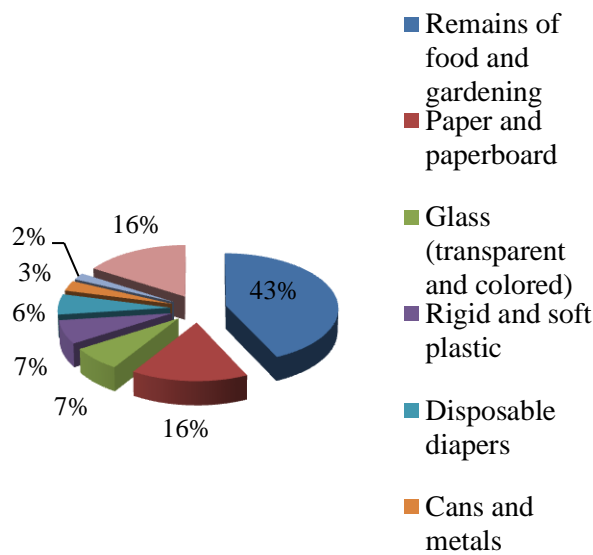
According to the provisions of Article 115 of the Political Constitution of the United Mexican States, municipalities are responsible for providing the services of cleaning, collection, transfer, treatment and final disposal of waste. Currently, both the large urban areas of the country and most municipalities of intermediate size have a regulation that establishes the responsibilities of both service providers and users (CPEUM, 2017).

Characterization of USW in Mexico

In developed countries the processing of the USW has become an industry, in Mexico the activity is recently regulated, especially in the final disposal stage, as permanent deposit or confinement in adequate facilities to avoid affecting the health of the population and the nearby ecosystems. In the country there are two types of disposal sites: sanitary landfills and controlled landfills, it should be noted that 36% of solid waste is not managed properly, although in 2011 there were 88 landfills and 21 landfills. controlled sites (SEDESOL, 2012).

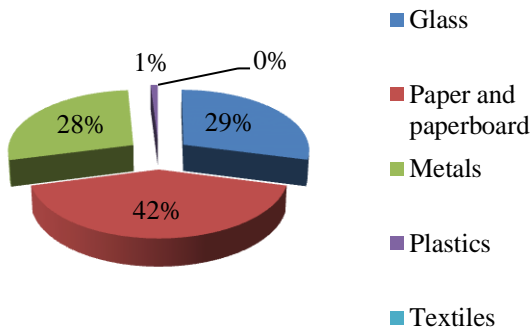
Solid waste in Mexico lacks a homogeneous composition, even in the same city, since on average, they are composed of 43.5% of food waste and gardening, 15.9% paper and cardboard, 7.4% glass (transparent and colored), 6.7% of rigid and soft plastic, 6.3% of disposable diapers, 2.9% of cans and metals, 1.5% of textiles and 15.8% of other waste, as shown in graph 1, where it can be seen that 43% are organic waste, 28% correspond to potentially usable waste and 29% to unusable waste (SEMARNAT, 2014).

Of the total of 2,445 Mexican municipalities, only 5% of the waste is properly handled, although 87% of the waste generated is collected and only 64% of the collected waste is confined in 88 sanitary landfills and 21 controlled sites; and 36% of waste is deposited in the open (SEMARNAT, 2015).



Gráfica 1. Average composition of garbage in Mexico
Source: Elaborated with data from (SEMARNAT, 2014)

In general, in Mexico the amount of recycled waste has increased, glass (28.6%), paper and cardboard (42.2%), metals (27.8%), plastics (1.2%) and textiles (0.2%) are recovered, as appreciates in graph 2 (SEMARNAT, 2014).



Gráfica 2. Composition of recycled waste in Mexico
Source: Elaborated with data from (SEMARNAT, 2014)

Landfills are the best solution in Mexico for the final disposal of USW; this type of infrastructure involves engineering methods and works to control leachate leaks and the generation of biogas.

On the other hand, controlled landfills, although they share the specifications of landfills in terms of infrastructure and operation, do not meet waterproofing specifications for the control of leachates. (SEMARNAT, 2015). The environmental effects caused by the improper handling of waste are contamination of soil, air (by the production of gases produced by the decomposition of garbage and its burning), interruption of water channels causing flooding or damage to the drainage system, contamination of lakes, lagoons, rivers and seas, contamination of groundwater and death of organisms by strangulation when trapped in elastic and fibrous materials.

USW processing

An efficient USW management considers various actions or activities to be carried out. These are considered from the generation source to the final disposal. The actions or basic activities that should be taken into account according to the following are listed below (Calva-Alejoy Rojas-Calderas, 2014):

- Generation
- Harvest
- Transfer
- Exploitation
- Final disposition

Generation

The generation of urban solid waste starts from the waste generated in the houses, which result from the elimination of the materials used in their domestic activities, the products they consume and their packaging, packaging or packaging; the waste that comes from any other activity inside establishments or in the public road that generates waste with domiciliary characteristics, and the resulting ones of the cleaning of the routes and public places, always that they are not considered like residues of another nature (PROFEPA, 2016).

Harvest

The collection of waste is the action and effect of collecting and removing solid waste from one or more generators, carried out by the person providing the service from the point indicated to the user for transfer (Pinzón Casas, 2016).

Transfer

It is the activity of moving the solid waste from the point indicated to the user of the cleaning system to the place of transfer, if it exists, or to the final disposal site through a vehicle avoiding the scattering of waste in an inappropriate manner (Pinzón Casas, 2016).

Exploitation

Other important activities within the management of the USW are the separation and use for recycling activities or reuse (Jiménez Martínez, 2015).

It is the process through which, through an integral management of solid waste, recovered materials are reincorporated into the economic and productive cycle in an efficient way, through reuse, recycling, incineration with the purpose of generating energy, composting or any other modality that entails health, environmental, social and / or economic benefits (Pinzón Casas, 2016).

Final disposition

It is the process of isolating and confining solid waste, especially non-useable waste, in a definitive manner, in places specially selected and designed to avoid contamination, and damage or risks to human health and the environment (Pinzón Casas, 2016).

In any of the two types of disposal sites: landfills or controlled landfills. With the above, if the points are properly fulfilled, USW management will not have any problem to conclude successfully.

Conclusions

Mexico is a country which has the capacity to achieve an adequate management of USW provided that the necessary financial support is given for the fulfillment and development of a rigorous national program of control and management of waste, which is capable of providing the information necessary for society to be aware of the damage caused to the environment due to poor waste management.

It is important to clarify that with the population participating in it and the government complying with the economic part, USW management will be adequately achieved and may lead to a greater and better use of waste, since from the generation will be separated and used for a more specific collection achieving a smaller amount in the deposition of waste; that is, a decrease in unnecessary waste or that can be recycled.

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Energy audit in the industrial sector of the beneficiary or cure of cocoa

Auditoría energética en el sector industrial del beneficiado o cura del cacao

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Abstract

In the state of Tabasco, a first-level energy audit was carried out on a rural production company dedicated to the beneficiation or cure of cocoa, as part of the project "Design, integration and start-up of an online digital platform for energy self-diagnostics of first level in the PyME of manufacture". The objective was to analyze the processes of fermentation, drying and packaging of cocoa, the energy flows of the equipment used (Samoa and rotary type dryers, electric motors, etc.), energy consumption (electric and thermal), electrical parameters, as the opportunities of energy efficiency and short-term or immediate economic savings. The thermal system depends to a greater extent on the consumption of LP gas and a minimum use of the available solar radiation. By means of the electric and LP gas billings for the years 2016-2017, graphs of the system's energy performance were obtained. An AEMC power pad 3945-B power analyzer was used in the 45 kVA transformer to monitor the main electrical parameters resulting in: low charge factor. Therefore, based on the results obtained, the possibilities of economic savings were proposed.

Audit, Energy, Cocoa

Resumen

En el estado de Tabasco se realizó una auditoría energética de primer nivel a una sociedad de producción rural dedicada al beneficiado o cura del cacao, esto como parte del proyecto "Diseño, integración y puesta en marcha de una plataforma digital en línea para realizar autodiagnósticos energéticos de primer nivel en las PyME de manufactura". El objetivo consistió en analizar los procesos del fermentado, secado y envasado de cacao, los flujos de energía de los equipos empleados (secadoras tipo Samoa y rotativas, motores eléctricos, etc), consumos de energía (eléctrica y térmica), parámetros eléctricos, así como las oportunidades de eficiencia energética y ahorro económico a corto plazo o inmediatos. El sistema térmico depende en mayor medida del consumo de gas LP y de un mínimo aprovechamiento de la radiación solar disponible. Mediante las facturaciones eléctricas y de gas LP de los years 2016-2017 se obtuvieron graficas del comportamiento energético del sistema. Se utilizó un analizador de redes AEMC power pad 3945-B en el transformador de 45 kVA, para monitorear los principales parámetros eléctricos dando como resultado: bajo factor de charge. Por lo tanto, con base a los resultados obtenidos, se propusieron las posibilidades de ahorros económicos.

Auditoría, Energía, Cacao

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Introduction

The costs of fossil fuels to generate electricity every day higher in world markets, as well as the high polluting emissions has caused our country to adopt new policies to implement renewable energy sources. Therefore, it is crucial that in the future our country does not depend on fossil fuels for the generation of electricity to a greater extent and the consequent reduction of generation costs. In the prospective of renewable energy 2016-2030, Secretariat of Energy (SENER, 2016) affirms:

In recent years, the development of energy sustainability has been sought in order to include the environment as one of the elements of competition that contribute to the economic and social development of the population. Hence, there is a clear commitment, derived from the Energy Reform: to foresee the gradual increase of the participation of Renewable Energies in the Electricity Industry, in order to meet the established goals in terms of clean energy generation and emission reduction. (p.131)

The cocoa sector in Mexico is at a disadvantage compared to the same business sector in other countries, this lack of innovation in the way they conduct their production processes, in the acquisition of new technologies, implementation of renewable energy and training of personnel in matters of energy saving awareness, therefore it is necessary to optimize the production costs in order to obtain more profits and the company can be profitable, it is for that reason that by applying a correct methodology to be able to diagnose the Real energy status of the company, may be offered, economic studies of the implementation of renewable energy as well as measures and actions to achieve energy efficiency (Manrrero, S., y González, I., 2006).

Performing an energy audit of the production process of traditional cocoa drying of a company or rural production society, dedicated to the benefit or cure of cocoa, allows us to identify all forms and energy sources to obtain the overall energy balance of the plant, analyze the potential areas of energy saving opportunities and implement a permanent program of actions and good use of energy.

The process of curing or benefiting of cocoa (post-harvest handling) is fundamental to achieve the quality required by the consumer market, it is the final process of cocoa production, where fermentation and drying takes place, therefore, it is a labor important and determinant of the organoleptic characteristics (color, aroma and flavor) of the grain (National Federation of Cacao Growers (FEDECACAO), 2004). The process of beneficiation or cure of cocoa consists of:

1. Harvesting: Only mature and healthy fruits should be harvested.
2. Parting of corncobs and shelling.
3. Fermentation: In the fermentation the flavor and aroma of the grain is developed, the newly extracted grains are deposited in wooden boxes and covered with sacks to maintain a constant temperature of fermentation, the fermentation time varies from 3 to 8 days depending on the type of cocoa and desired final product, you have to move it every 24 hours to achieve a uniform fermentation.
4. Drying: There are two types of dried, the natural taking advantage of the available solar radiation, which is the most economical and artificial drying using fossil fuels, both methods must be performed slowly and at low temperatures, until a moisture content between 6 and 8%.
5. Cleaning, sorting and packing.

The process that most consumes non-renewable energy resources is undoubtedly the drying process, which consumes large quantities of LP gas and electricity from the CFE network.

The importance of implementing solar dryers for cocoa beans, responds to the need to look for alternative and sustainable technologies, which allow to protect the grains of adverse weather conditions, obtain a product that has quality and achieve drying even with diffuse solar radiation, but above all, to reduce the consumption of LP gas and electricity of the CFE network in the drying process, with the consequent economic benefits for the cocoa sector.

An adequate awareness or energy culture among the cocoa population contributes to a sustained economic development of the sector and the country.

Having technical and economic studies on production expenses in terms of electricity, heat, etc., against the profits obtained, will allow us to obtain a vision of future growth of the company, avoid uncertainty and achieve energy efficiency.

In addition, the use of photothermal and photovoltaic solar energy in the national cocoa sector will reduce the demand for fossil fuels and electricity in the national electricity system, as explained in section 2.

Section 3 describes the activities carried out during the audit. Then section 4 details the production process of the company. Section 5 describes all the information surveys carried out by each of the systems found.

Section 6 analyzes the electrical system in detail, as well as the analysis of the electric billing provided by the company and the report of the substation obtained by monitoring the network analyzer.

Section 7 analyzes the thermal system and the lp gas billing used as fuel. Section 8 shows the total amounts of energy used during the production process of the company, as well as their percentages. Finally, section 9 shows short and long-term energy saving measures, as well as good practices in energy saving.

Current situation

Cocoa producers in Mexico lack investment, training and future projection in their production processes, this causes stagnation or closure of the company.

The costs of fuels, the increase in electricity tariffs has a huge impact on the company's profits, the low implementation of renewable energies means that it depends exclusively on fossil fuels and on the electric power of the national electric interconnected system, this to the long will cause serious problems of over-demand of energy. "In 2015, energy consumption in Mexico exceeded, for the first time, the production of primary energy with a 3.2% difference" (National Energy Balance, SENER, 2016, p.136).

The low productivity of cocoa at the national level, the low prices given by the international fluctuations of the stock market, added to the incidence of the moniliasis of cocoa, made this activity of agricultural production an unattractive and low incentive for the farmers (Quintero, M. L., y Díaz, K. M, 2004).

The traditional drying of cocoa, consists of removing the humidity of the grain and by means of evaporation to transfer it to the environment. The amount of moisture that the air can absorb depends on its temperature, as the air heats up, the water particles evaporate from the grain and these are absorbed by the air, therefore, the consumption of LP gas and electricity is predominant in the process.

That is why once detected one of the main problems faced by cocoa producers in Mexico, which corresponds to the low profitability in the process of transformation of their raw materials towards the final product, compared to the increasingly expensive costs of the energy (electrical, thermal, etc.) that were used in said production, it is of significant importance to promote actions that benefit their development in terms of energy efficiency, for which an energy audit was carried out to a traditional cocoa drying company, to know its real energy situation and to be able to propose saving measures that directly benefit the economic profitability of the company.

Description of the method

On November 27, 2017, an energy audit was conducted in a rural production company located in Cunduacán, Tabasco, belonging to the food industry of the secondary sector in the transformation of goods, dedicated to the benefit or cure of cocoa.

The facilities have a processing area and warehouses where cocoa beans are stored, with and without benefits, as well as an office area, buying and selling and accounting. It has a staff of 25 employees and the services it has are: bathrooms and common area.

To cover all the areas and activities carried out in the facilities of the plant, the work team was divided into two groups, thus speeding up the work of data collection and measurements.

The activities carried out are listed below:

1. A tour of the facilities was conducted in order to know the different areas of work, the manufacturing process, the raw material, equipment and machinery used.
2. Monitoring of electrical parameters by AEMC network analyzer model: 3945-B (AEMC INSTRUMENTS, 2012). Said equipment was installed on the main board of the electrical installation with the purpose of monitoring the main electrical parameters of the different charges and the most consumed equipment.
3. The data collection of the different equipment installed in the work areas of the plant was carried out. During the survey, force equipment (electric motors), Samoa-type dryers and rotary machines, lighting equipment, office equipment and pumping equipment are taken into account. At the beginning of the activities, Team 1 decided to start with the raw material area: fermentation, drying, bagging and selection, buying and selling area and patio. Team 2 was dedicated to perform data collection in the following areas of the plant: main office, warehouse and warehouse. In the case of offices, miscellaneous equipment (computers, laptops, printers, coffee makers, etc.), air conditioning and lighting equipment are taken into account.
4. Afterwards, after collecting all the information, the network analyzer team was removed and the staff was thanked for the facilities provided.

Productive process

The "big" cocoa harvest is presented annually, between October and May. The raw material used (cocoa beans) comes mostly from the contribution of local partners and farmers, therefore, the process begins with the purchase of these grains, in the plant there is no harvesting, splitting of cobs or shelling.

The villagers of the town take to sell their grains at the doors of the plant. Then, so that cocoa can be converted into chocolate, it must first go through two main processes: fermentation and drying, in which it develops the characteristics of flavor and aroma that define its quality.

Fermented area: Fermentation cleans the seeds and avoids the germination of these. During fermentation, the combined and balanced action of temperature, alcohols, acids, pH and humidity kill the embryo, decrease the bitter taste and produce certain biochemical reactions that form the chocolate (Secretary of Agriculture of Antioquia, 2008).

The fermentation time used in the plant depends on the requests of the clients, but it must not be longer than three days for the white or cotyledon cocoa and greater than eight days for the foreign or purple or purple cotyledon cocoas. The fermentation takes place in wooden boxes, as shown in fig 1.



Figure 1 Fermented area

Source: Own photo

Drying Area: The drying allows the seeds to lose the excess moisture and during this time the changes are finished to obtain the chocolate flavor and aroma. Changes in color also occur, appearing the typical brown color of cocoa. During drying, the ideal is to reduce the moisture content of the seeds from 55% to 6 or 8%. The drying methods they use are:

1. The natural drying in the outdoor patio by taking advantage of the sun, as shown in figure 2, is the most economical since it uses radiant heat from the sun's rays, however, it is used to a lesser extent in the plant.



Figure 2 Drying in patio
Source: Own photo

2. The Samoa-type dryer, in which a stream of hot dry air is passed through the cocoa arranged on a platform or bed, uses LP gas for the burners and electric power for the fans, as shown in Figure 3.



Figure 3 Samoa type dryer
Source: Own photo

3. Commercial Rotary Dryers, originally designed to dry coffee beans, are used to dry cocoa beans using LP gas burners and electric power, as shown in Figure 4.



Figure 4 Rotary dryer
Source: Own photo

The Samoa and rotary dryer are the main equipment used in the plant for this purpose, after drying the cocoa beans are ready to be packaged and offered to their consumers or customers.

Lifting charges

The facilities of the company have different types of charges among which are:

- Charges for lighting equipment. The company has compact fluorescent lamps of 26, 45 and 105 W where most are located in the process area, offices, warehouse and drying yard. There are also 75W T12 lamps in the process area.
- Charges for air conditioning equipment. It has a team of 1.5 tons (18,000 BTU) of conventional technology R22.
- Charges for electric motors of alternating current. These engines are located in the drying, fermented areas and the power varies from 0.5 to 10 Hp, where most are standard efficiency.
- Charges for pumping equipment. In what corresponds to pumping equipment, there are 4 centrifugal pumps with capacities of 0.5, 1 and 1.5 Hp.
- Charges by miscellaneous teams. The charge for miscellaneous equipment refers to the various office and laboratory equipment (ventilator, TV, printers, laptop, incubator, coffee makers, etc.) found in their facilities.

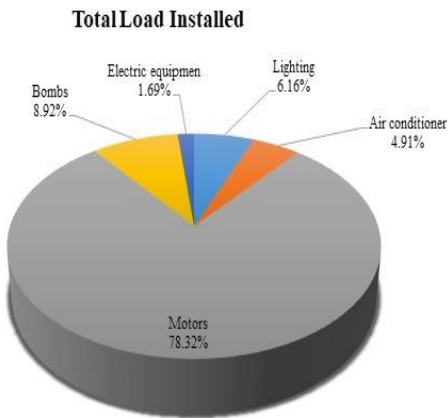
According to the survey carried out for connected charges, the total installed power was determined by type of system and the percentage of charge represented by each system with respect to the total installed kW, as shown in table 1 and figure 1.

The lighting and air conditioning system includes all the equipment found in all areas of the industrial warehouse, as well as the AC motor systems (installed in Samoa type dryers and rotary), pumps and miscellaneous equipment.

Sistem	Charge [kW]	%
Illumination	2.32	6.16%
Air conditioner	1.85	4.91%
Ac motors	29.487	78.32%
Bombs	3.359	8.92%
Miscellaneous team	0.635	1.69%
Total	37.65	100%

Table 1 Total charges installed by system
Source: Self Made

For a better perception of the charges installed by system, figure 1 shows that the highest installed charge corresponds to 78.32% alternating current motors, then to pumps, lighting and air conditioning and charges for miscellaneous equipment only represent a value of 1.69%.



Graphic 1 Percentages of charges installed by system
Source: Self Made

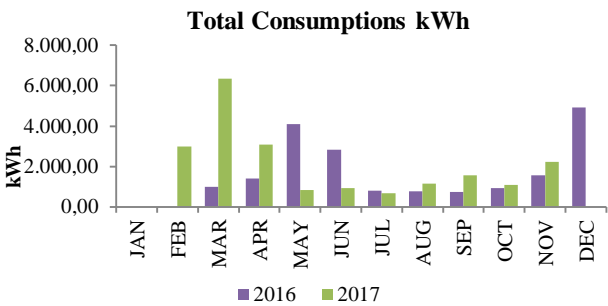
Electric system

The electric power supply service by the Federal Electricity Commission (CFE) is carried out through the ordinary medium voltage (OM) tariff, which has a pole-type substation with a capacity of 45 kVA, a main switch of 100 A and a contracted demand of 21 kW according to billing receipts, so that the company has a 3-phase-4-wire electrical system.

Electric billing analysis

Electric energy billings were processed and the graphs obtained for energy consumption [kWh] and maximum demand [kW] corresponding to the years 2016-2017 were analyzed in the ordinary rate for medium voltage general service with demand less than 100 kW (Rate OM).

The energy consumption in kWh for the different periods of 2016 and 2017 show significant differences as shown in figure 2, which corresponds to the harvest months of October to December and the second harvest of March to May, of each year respectively.



Graphic 2 Behavior of annual energy consumption (2016-2017)
Source: Self Made

The total energy consumption for the year 2017 has increased, compared to the previous year and there is a peak of energy consumption for the month of March 2017 which is much higher than the month of March 2016 and the peak December 2016, so it can be assumed that production increased considerably.

The maximum demand of the years 2016 and 2017 are shown in figure 3, we can see that the maximum demand values coincide with the seasons of high and low production.

The average maximum demand during the period of highest production (March-April) exceeds the contracted demand, this due to the availability of the obtained cocoa harvest volumes, which is variable per year..

There are 4 periods in 2017, where the maximum demand measured exceeds the contracted demand, the above is not a reason for reclassifying the OM rate to the HM rate since it does not exceed 100 kW.



Graphic 3 Maximum demand behavior (2016-2017)
Source: Self Made

With regard to the charge factor, when averaging the values shown in the electricity bill for 2017, it shows a value of 13%. This value indicates that the contracted power is not used in the company because they depend to a large extent on the harvest seasons.

Report of the 45 kva substation

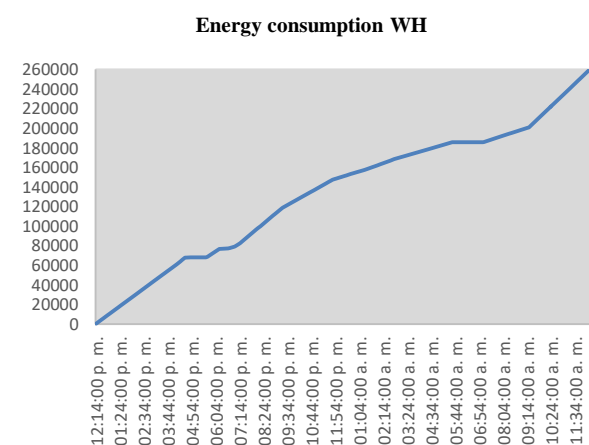
The monitoring was carried out in the main substation of 45 KVA through the electrical power quality and network analyzer brand AEMC 3945-B. Which was installed in the main switch of 100 A.

The readings of the measurements were made in periods of 2 minutes. The total period of the measurement was 24 hours, on November 27, 2017. Next, the parameters are described according to the data obtained.

1. Energy consumption (wh)

The energy consumption measured in the substation is shown in figure 4. Consumption monitoring was recorded for a period of 24 hours from 12:14 pm on day 27/11/2017 to 12:14 pm on day 28/11 / 2017.

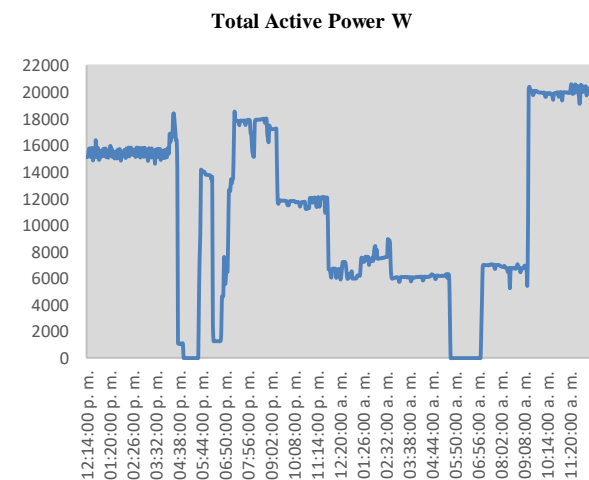
The maximum value of the mentioned measurement period was 259.03 kWh, however, it is important to mention that the production was not 100%.



Graphic 4 Behavior of the total energy consumption of the day 27-11-17
Source: Self Made

2. Active power (kw)

By means of the demand data that we obtained from the analyzer we can observe in graph 5 the maximum and minimum demand behavior obtained in the monitoring period.



Graphic 5 Behavior of the active power of the day 27-11-17
Source: Self Made

The demand for average active power under normal working conditions has a value of 18 kW, according to figure 5. Around 5:00 pm on November 27 and at 5:30 am on November 28, demand decreases drastically, which corresponds to the change of employee shift.

The power remains stable between 18 and 20 kW from 9:00 a.m. to 5:00 p.m. of each working day during the strong harvest period, which coincides with the morning work schedule and because in the day is when the partners take to sell their cocoa beans to the cooperative.

The substation has a capacity of 45 KVA, and according to measurements recorded by the network analyzer, the maximum value measured was 29.79 KVA.

From the above it is concluded that 66.2% of the transformer capacity is being used, which is within the operating limits of the transformer efficiency.

Thermal system

The thermal system used depends to a greater extent on lp gas consumption for the drying of cocoa and a small percentage on the use of solar radiation in the outdoor drying patio.

Gas billing analysis lp

The following table 2 shows the consumption in liters of LP gas, the energy in megajoules MJ and the cost in pesos, according to the invoices provided for the year 2017, as we can see the lp gas purchases correspond to the months of production and the annual consumption for 2017 was 49,479.

2017	GAS LP Liters	MJ	Cost \$
Jan	8,479.00	224,201.72	\$63,399.52
Feb	10,874.00	287,530.31	\$81,473.29
Mar	16,493.00	436,107.91	\$124,313.11
Apr	1,692.00	44,739.86	\$12,673.08
May	0.00	0.00	0.00
Jun	0.00	0.00	0.00
Jul	0.00	0.00	0.00
Aug	0.00	0.00	0.00
Sep	4,728.54	125,032.05	\$37,384.08
Oct	1,788.11	47,281.20	\$15,332.07
Nov	5,424.80	143,442.56	\$50,125.15
Dec	No disponible	No disponible	No disponible
Total annual	49,479.45	1,308,335.62	\$384,700.31

Table 2 2017 LP gas consumption
Source: Self Made

Where the PCS of LP gas equals 26,442 MJ / l

Total energy used in MJ / year

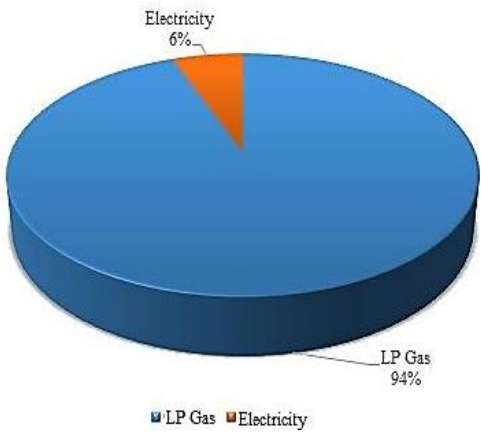
In the company two types of energy are used for the development of activities during the year 2017, electric power, which is charged with feeding the electric motors that are required during the processes and the thermal energy that is used for the drying of cocoa.

Total Energy Consumption 2017		
Gas LP	1,308,335.62	MJ / year
Electricity	80,794.80	MJ / year
Total	1,389,130.42	MJ / year

Table 3 Total energy consumption of 2017
Source: Self Made

In figure 6, you can see the percentages of distribution in the consumption of the energy used.

Total Energy Consumption MJ/año



Graphic 6 Total energy consumption in MJ / year of 2017
Source: Self Made

For all this we can conclude that lp gas consumption is the predominant and that the most money costs the company, only until the month of November 2017 represented an expense of \$ 384,700.31 which is why it is important to reduce consumption.

Energy saving measures

Short-term measures

Lighting: A decrease in electricity billing will be obtained, using natural lighting during the day through the use of translucent sheets or turning off the lamps in those areas that are left without activity, this applies to the drying and fermentation area, where you have some translucent sheets, which require cleaning and maintenance.

Air conditioning: During the tour in the facilities Minisplit type air conditioning equipment was observed, it is important to mention that air conditioning equipment requires a minimum of preventive maintenance twice a year, in order to avoid increases in energy consumption of the teams (Sanz, J. G., Cuadros, F., y López, F., 2011).

Engines: Motors require preventive maintenance due to cocoa residues preventing the correct heat dissipation of the motor, as well as cleaning of connection boxes, bearings and bands.

Samoa type dryers: Samoa type dryers should be thermally insulated in a proper way to avoid heat transfer to the outside.

Long-term measures

The proposals for long-term energy savings involve the replacement of technologies as shown in the guide to develop an energy diagnosis in real estate (SENER, 2013).

Lighting: The lighting system in the different areas of your company consists of outdated technology T12 75 W tubular lamps and compact fluorescent lamps of 26, 45 and 105 W. For the above, it is proposed to use more efficient technologies such as lamps led to reduce energy consumption providing the necessary lighting conditions for the performance of the different activities.

Air conditioning: In the facilities there is a minisplit air conditioning system, of conventional technology, therefore it is proposed to consider the use of minisplit inverter equipment.

Dryers: The use of dryers for hybrid greenhouse cocoa is proposed, alternating renewable energy (solar thermal and photovoltaic) and conventional energy to a lesser extent (LP gas and electricity from the CFE network). These dryers allow the cocoa beans to be dehydrated by means of a heat transfer process by convection between hot water generated by the solar collectors and a forced ventilation system. (Maupoey, P., Andrés, A., Barat, J. y Albors, A., 2001).

The renewable energy system consists of a photothermal system that allows to heat the water necessary to reach an air temperature inside the drying chamber at 60 ° C and a photovoltaic system that is charged with generating the energy to power the equipment. pumping and heat exchanger, all this without affecting the sensory properties and quality of cocoa.

Good practices

Air conditioner:

1. Create and implement a preventive maintenance plan that allows maintaining a correct level of service in the equipment.
2. Replacement of damaged or damaged thermal insulation.
3. Verify the absence of unwanted heat sources in the air conditioning areas.

Lighting:

1. Have an inspection and maintenance program to obtain an efficient operation and avoid unnecessary energy consumption.
2. Check for false contacts, hot spots and dust accumulation.
3. Implement a program for changes in lighting schedules, uses and customs of the staff.
4. Avoid over lightening, as well as unnecessary sources of light.
5. Replace obsolete T12 technologies with T5 or LED.

Bombs:

1. Check the alignment between motor and pump, avoiding stresses that reduce the service life of the bearings.
2. Prevent the pump from operating without fluid.
3. For motors greater than 1 Hp, it is recommended to use an independent electric circuit.
4. Place flexible joints to prevent the propagation of vibrations and stress from the pipe to the pump and vice versa.

Motors:

1. To the extent possible make use of high efficiency engines.
2. For large capacity motors, the use of a starter is recommended since it improves the operation and extends the useful life of the motor.
3. The motors have an average lifespan between 15 and 20 years. Replacement is recommended after that period.
4. Check the accessories that are attached to the motor for the purpose of replacing said parts (belts, chains, bearings, etc.)

5. Verify that the engine ventilation system is free of dust

Substation:

1. Create a preventive maintenance plan that allows to keep the transformer in optimal conditions.
2. Maintain ground connections of equipment in good condition.
3. Maintain the area of the substation in orderly and clean conditions.

Conclusions

One of the main problems faced by cocoa producers in Mexico is the low profitability of the way in which they transform their raw materials into their final products, against the increasingly expensive costs of energy (electric, thermal, etc.) that were used in said production process.

Cacao growers in Mexico, being an important part of the country's economy, economic development and generating jobs, it is of significant importance to promote actions that benefit their development in terms of energy efficiency, so perform an energy audit in the company of cocoa drying, allows us to know your real energy situation and to propose saving measures that directly benefit the economic profitability of the company.

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Cost-benefit analysis in the modernization of the residential low-voltage measurement system in Mexican territory

Análisis costo beneficio en la modernización del sistema de medición en baja tensión residencial en el territorio mexicano

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Abstract

The modernization of the measurement in low residential voltage has caused inconveniences to the consumers of the CFE (Comisión Federal de Electricidad). This research aims to identify advantages and disadvantages offered by the implementation of electronic meters in the Mexican territory. The electronic measurement system offers precision reliability and control of user consumption. However, electromechanical meters have up to 5% error in the measurement. A cost-benefit analysis in the modernization of the measurement was carried out considering the socioeconomic, cultural and service environment to identify the advances offered by the modern measurement system concerning the one implemented in the country. The results determined that both systems are vulnerable, due to technological progress. The electronic cards could be reprogrammed electronically without altering their physical appearance which generates that the anomalies to the system of measurement by the company of supply are not detected. On the other hand, the costs incurred for modernization by the Mexican government and the supply company may not yet be fully amortized, and the new measurement system could cease to be reliable before its obsolescence.

Modernization, Cost-Benefit, Low Voltage

Resumen

La modernización de la medición en baja tensión residencial ha causado molestias a los consumidores de la CFE (Comisión Federal de Electricidad). Esta investigación tiene como objetivo identificar ventajas and desventajas que ofrece la implementación de medidores electrónicos en el territorio mexicano. El sistema de medición electrónico ofrece precisión confiabilidad and control del consumo del usuario, sin embargo, los medidores electromecánicos presentan hasta un 5 % de error en la medición. Un análisis de costo beneficio en la modernización de la medición fue llevada a cabo considerando el entorno socioeconómico, cultural and de servicio para identificar los avances que ofrece el sistema de medición moderno con respecto al implementado en el país. Los resultados determinaron que ambos sistemas son vulnerables, debido al avance tecnológico. Las tarjetas electrónicas podrían ser reprogramadas electrónicamente sin alterar su apariencia física lo cual genera que no sean detectadas las anomalías al sistema de medición por la compañía de suministro. Por otra parte, los costos realizados para la modernización por el gobierno mexicano and la compañía de suministro posiblemente no serán aun amortizados en su totalidad, and, el nuevo sistema de medición podría dejar de ser confiable antes de su obsolescencia.

Modernización, Costo-Beneficio, Baja Tensión

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Introduction

The CFE together with the Mexican Federal Government has implemented a modernization program for low voltage measurement in order to have better control of consumption and an improvement in the finances of the supply company (Cruz S.N., 2016).

The objective is to identify the advantages and disadvantages offered by the implementation of electronic meters in Mexican territory.

The electronic measurement system offers precision reliability and control of user consumption, however, electromechanical meters have up to 5% error in measurement. A cost-benefit analysis in the modernization of the measurement was carried out considering the socioeconomic, cultural and service environment to identify the advances offered by the modern measurement system with respect to the one implemented in the country. (Diario Oficial De La Federación and CFE, 2017).

In 2012 an open call was launched for a tender for the project called "modernization of low-voltage measurement". As a result of this process, a leading company in the electrical industry won two contracts, the first of which consisted in the installation of 30 million 428 thousand 665 electronic measuring equipment with a cost of 12 thousand 250.4 million pesos and the date of settlement 2014.

The second contract was of 4 million 321 thousand 974 teams, with a cost of 6 thousand 890.6 million pesos which had to be carried out in the period of 2014-2016 (Cruz S.N., 2017).

The total project of the modernization of the measurement in the country has a total of 34 million 750 thousand 639 digital power meters with a total cost of 20 thousand 167 million pesos. In addition to this, the maintenance and operation services for these equipment were contracted for a period of 33 years with a cost of 1 billion 131 billion pesos (Cruz S.N., 2017).

For the year 2017 the company that won the tender reports that they had had an advance in the implementation of the measurement of 73.77% for the first project and 21.5% for the second.

The company reports that it did not reach the stated objectives because it faced problems such as the opposition of users to the change of the measurement system, especially in the states of Hidalgo, Puebla, Morelos, Veracruz, Tabasco, Yucatan, Chihuahua where in response to the change of meters were generated riots, rallies and in some cases were ripped and thrown in front of the corresponding government offices (Cruz S.N. and Lazáro, 2017). This is due to the fact that users attribute that these systems are not reliable in the measurement, and that rumors have been generated that they are previously programmed to increase consumption. (Cruz S.N. and Lazáro, 2017). On the other hand, it is believed that the main cause of the unacceptance of these systems is that electronic meters are prepaid and in Mexico, users are accustomed to the fact that the company finances the energy supplied until the cutoff date. However, all the equipment installed by CFE is tested by the laboratory equipment and materials (LAPEM) and they have gone through a process of calibration and metrology that ensures their proper functioning in laboratory and field. (Laboratorio de Pruebas Equipos and Materiales "LAPEM" 2017). On the other hand, the supplier company in order that users accept the change has implemented a program so that electronic measurement systems have the possibility of belonging to the prepaid or payment system at the cutoff date. (Cruz S.N., 2017).

An engineering analysis of the modernization of measurement systems evaluated the pros and cons of this system, finding that resistance to change is due to external factors that obey other interests (Political, social, cultural and economic) and not precisely related to technological development (Cruz S.N., 2016). On the other hand, no measuring system escapes from being altered by external means, so it is considered that these have a pre-established safety by the manufacturer and that some world powers follow this trend in the measurement (Mendieta, 2015). However, a total opposition to the change puts the supplying company in a technological backwardness, which in agreement with the Federal Government provides the subsidies in low tension and that in the worst scenarios, supplying the service by a foreign company could generate new reforms to the subsidies or even exterminate them (Cruz S.N., 2016).

Legal framework

According to the Energy Regulatory Commission, for the second time in a row, the Official Mexican Emergency Regulation NOM-EM-007-CRE-2017, for electrical energy measurement systems with their respective specifications and test methods for multifunction meters and transformers instrument, with number of agreement A / 033/2017, which establishes that on the occasion of the Decree by which various provisions of the Political Constitution of the United Mexican States on Energy are amended and added, published in the Official Gazette of the Federation (OGF) on December 20, 2013, the Congress of the Union issued the Law on the Electricity Industry (LEI) and the Law of the Coordinated Regulatory Bodies on Energy Matters (LCRBEM), both published on August 11, 2014 in the same means of dissemination, repealing the Public Electricity Service Law and the Law of the Energy Regulatory Commission (NOM-EM-007-CRE-2017).

According to article 40, section IV, of the LFMN, the official Mexican standards will have, among others, the purpose of establishing the characteristics and / or specifications related to the instruments to measure, the measurement standards and their methods of measurement, verification, calibration and traceability (NOM-EM-007-CRE-2017).

The elements of the electric power measurement system must comply with what is stated in this Official Mexican Official Standard of Emergency with the operating conditions of the electric network, being focused on the safety of the elements that make up a measurement system according to the Official Mexican Standard NOM-001-SEDE-2012, of electrical installations.

In its third section the energy regulatory commission establishes the administrative support, the orientation to make transparent to the citizenship the operative and administrative activities of the energy regulatory commission with the purpose of finding a competitive and sustainable energy market development for the benefit of the society in order to generate certainty that encourages productive investment, fostering healthy competition, promoting adequate coverage and security in the electricity supply.

Based on a legal framework of the Political Constitution of the United Mexican States (OGF 05-02- 1917), and in laws such as: Law on Coordinated Regulatory Bodies in Energy Matters, Electricity Industry Law, Energy Transition Law, Federal Law on Consumer Protection, to mention a few (Comisión Reguladora de Energía, 2017).

On the other hand, we have the Code of Conduct of the Energy Regulatory Commission in order to guide the performance of the Public Servants of the same, with the purpose that in the exercise of their functions they assume a full and honest attitude, in adherence to the institutional values of rectitude, honesty, impartiality, respect and transparency, taking into account the Internal Regulation of the Energy Regulatory Commission (OGF 04-28-2017) and the Decree by which the Energy Sectorial Program 2013 is approved -2018 (OGF 13-12-2013) where the strategy is to promote the sustained growth of productivity in a climate of economic stability, as well as the efficient use of productive resources, strengthening the business environment, and establishing sectoral policies for boost economic development. There are several Plans and Programs such as: National Development Plan 2013-2018, Sector Energy Program 2013-2018, Program for the Development of the National Electric System 2015-2029, all of them under the guidelines of the Energy Regulatory Commission (Official Gazette of the Federation, 2013).

The Energy Reform approved on December 20, 2013 by the Congress of the Union was the trigger for the modernization of the energy sector without privatizing the Mexican State public companies engaged in the production of electricity. The reforms have as objective and fundamental premises to modernize and strengthen without privatizing the Federal Electricity Commission as a 100% Mexican productive company allowing the nation to exercise exclusively the planning and control of the national electrical system having a competitive system that allows to reduce the prices of electric power, without neglecting international standards of efficiency, quality, transparency and reliability of supply in accountability, effectively combating corruption in the energy sector and promoting greater investment to boost development in the country. (Energetic Reform, 2013).

A comparison of electricity prices in the Mexican sector represents an average of 25% more than in the United States, considering the subsidy from the Federal Government already included. If this were not taken into account, the price of electric power would be up to 73% higher, constituting a brake on the Mexican economy, given that the essential input for residential, industrial, commercial and service activities is electricity.

The CFE reported energy losses in Mexico of about twice as much as the countries that make up the Organization for Economic Cooperation and Development (OECD). On the other hand, statistics of the CFE establish billing losses of up to 15% due to different problems related to the measurement (lack of access to the meter, erroneous measurements, alteration of the measurement system) which places the company in a state critical since international business statistics establish that no company can support more than 21% of losses without presenting financial problems (Energetic Reform, 2013).

The Energetic Reform has the Constitutional Article 27 that establishes that the planning and control of the national electrical system, as well as the transmission and distribution of electric power correspond exclusively to the Nation and in the Constitutional Article 28 establishes that the planning and control of the system national electricity, as well as the public service of transmission and distribution of electricity are exclusive areas of the State for the benefit of Mexicans, in terms of generation and commercialization of electric power. However, the constitutional reform established at the end of 2013 allows the opening of private investment (Energetic Reform, 2013).

Considering that the National Energy Control Center, which before the reform was part of the CFE, is transformed into a decentralized public body in charge of the operational control of the national electricity system (SEN), it assumes responsibility for the monitoring of production vs billing.

For this, the energy coming from clean sources belonging to the sustainable development programs must be considered (Constitutional Reform in Energy Matter, 2013).

Methodology

This research has a quantitative, qualitative and mixed approach applying a set of systematic, critical and empirical processes. Using the quantitative approach was carried out a cause and effect analysis in a sequential, deductive process with an objective reality analysis predicting a hypothesis for the control of this research. Regarding the qualitative approach, the phenomena related to the problem were explored in depth, proposing possible results of the data obtained under an inductive process recurrent to the subjective reality; contextualizing the phenomenon for different sources of research such as: written materials (books, newspaper articles, notes) as well as web pages. The definition of the scope of the research carried out quantitatively must be taken into account by combining the descriptive, correlational and explanatory scopes considering the phenomenon studied and its components, offering a relationship between variables with a sense of understanding that is easier to understand. The design of longitudinal non-experimental quantitative research is needed, because changes over time were analyzed observing this phenomenon as they occur in their natural context, and then analyzing it based on observations of existing situations (Hernández, 2010, p.275).

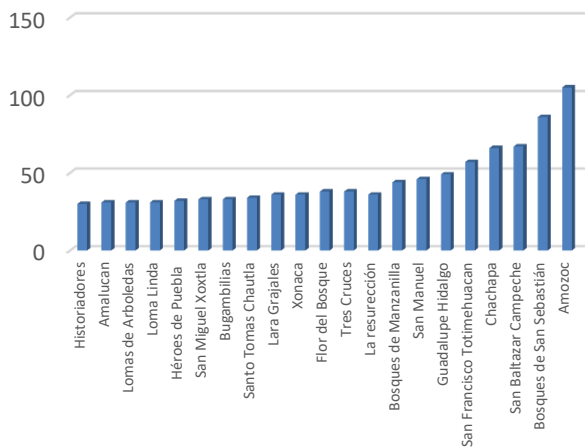
Population and Sample

The data collection was done through the qualitative and quantitative approach applying the deductive logic from the general to the particular, from the laws and theories to the data preceding the collection. Pretending to generalize the results of the research, we had a descriptive analysis of the data according to the variables, explaining the movements and changes processed by the database. The results obtained through the mixed approach involve combining the quantitative approach with the qualitative one, resulting in tables, statistical models verifying the feasibility criteria (Hernández, 2010, p.275).

Our population includes the entire Mexican Republic with more than 123 million 518 thousand 270 inhabitants until 2017 (Sagarpa, 2018). Once the unit of analysis is defined, the population is delimited taking a subgroup of the total population, from which the data was collected.

Non-probabilistic samples were taken as references in the Bosques de San Sebastián Housing Unit located in the Puebla Oriente distribution area (POA). The energy generated for this zone comes from the Laguna Verde nuclear power plant located in the state of Veracruz and the San Lorenzo Potencia combined cycle plant in Puebla, which supply the Puebla Dos Mil power substation, while the Chicoasén and Malpaso belonging to the state of Chiapas supplies the Tecali power substation. Both substations are supplied through 440 kV transmission lines, after the power substations (Tecali and Puebla Dos Mil) and through 115 kV lines are transmitted to the distribution substations that make up the POA. The study area is supplied by the Bosques substation, which is one of the 13 substations installed in the POA, in charge of reducing medium voltage voltages in either 34.5 or 13.5 kV lines and these in turn through transformers are reduced to low voltage (127 or 220 volts) to be sold residually. (CFE, 2017).

According to CFE billing reports belonging to the study sample until August 2017, there were a total of 6,118 residential customers that have an analog measurement system. The POA has 8 branches in which were received the disagreements of the colonies and populations that are within the jurisdiction. To establish the sample, it was necessary to consult the nonconformities presented by each thousand users (IMU). The sample was selected based on the IMU statistics in the POA for the low voltage service, identifying that the Forest Unit of San Sebastián registered a greater number of nonconformities. (CFE 2017).



Graphic 1 IMU for CFE colonies
Source: Self Made

1 Plan for the modernization of the measurement system

The CFE intends to change 4000 electromechanical meters by digital meters in the U.H. Forests of San Sebastián. A technical and economic proposal that complies with the general provisions regarding acquisitions, leases, contracting of services and execution of works by its Productive and Subsidiary Companies under the specifications of the 30 fraction V provision, complying with the stages and deadlines convened in the open contest, in order to dictate a winner who will carry out the modernization works of the digital meters (Federal Budget Law and Fiscal and General Public Debt Responsibility, 2006).

2 Estimated costs for the modernization of the measurement system

Taking into account a previous analysis of the modernization of the measurement system, it was necessary to evaluate possible alternatives that can be presented in such a project with the sole purpose of giving the best solution and being able to take the most convenient decision to guarantee the viability and objectivity, between Cost, quality and execution time.

To determine the cost it was necessary to call open competitions, as well as offers and auctions for the contracting of the service of modernization of the measurement system to be able to choose the best option in accordance with the general provisions of CFE. (Cruz S.N. and CFE, 2017).

It has the purpose of making the analysis as accurate as possible, for this it is inevitable to consider inputs, returns and the number of workers needed to carry out this project. A calculation memory was made to obtain the necessary technical information and the costs of the project, optimizing its execution.

This project is integrating the cost through the unit price method, defining activities, labor and inputs needed to make the change of 4000 meters. Each of the concepts is specified, the duration of each activity based on the returns with respect to each activity, however, only the resulting values were taken to be presented in this work table 1. (Cruz S.N. and CFE, 2017).

Unit Cost without Accessories		Unit cost of accessories	
Unit Price per meter change	\$ 188.74	Unit Price Digital Meter	\$ 1,202.33
		Unit price safety rings	\$ 23.50
		Unit price bolt seal	\$ 1.52
Meters to change	4000		
A) Project cost without accessories	\$ 754,970.08	B) Total cost of accessories	\$ 4,909,400.00
C) Project cost (A + B) without VAT and Finiquito: \$ 5,664,370.08			
D) VAT 16%	\$ 906,299.21		
F) Settlement of workers	\$ 0.00		
Total project cost (C+D+F)	\$ 6,570,669.29		

Table 1 Supplies needed to change digital meters
Source: Self Made

Results

Estimated time the investment will be recovered

A domestic user of the U.H. Forests of San Sebastian, consumes 182.8 kWh monthly average with an approximate cost of \$ 1.52 MXN per kWh, however, studies carried out in electromechanical meters report up to $\pm 5\%$ of error in the reading of the total consumption of the user per month, which corresponds approximately to a range of 10% (18.28 kWh) on average representing a loss of \$ 27.8 on average per customer on a monthly basis (CFE, 2017).

However, the digital meter due to the technology with which it was manufactured reports errors of up to $\pm 0.5\%$ of the measurement which corresponds to approximately 1%, of total error (1.82 kWh) per customer per month, meaning \$ 2.77 MXN and representing 9.9% with respect to the losses generated in an electromechanical meter.

If it is considered that the losses in an electromechanical meter represent 100%, which will have to be paid in the billing and on the other hand, the losses generated by a digital meter would save 90% of this amount in the billing payment.

Therefore, the change of electromechanical meters by digital, based on the "2017 population census" establishes that 65.4% (4,000 meters) of UH Bosques de San Sebastián customers still have the electromechanical meters of 6,118 total customers reported by the CFE until August 2017. (CFE, 2017).

This represents approximate energy losses of 36,560 kWh per month (438.72 MWh per year) in that area, which are not billed for using the electromechanical measurement system which represents \$ 55,571.2 MXN monthly, therefore \$ 666,854.4 MXN per year.

The modernization of the meters of this project in the U.H. Bosques de San Sebastián will cost \$6,570,669.29 MXN. If you consider the annual loss that would be generated from the meters to change, this amounts to \$ 666,854.4 MXN. Given this scenario, the investment would recover in approximately 10 years (present value 2017), because the losses generated by the electromechanical meters would represent approximately the cost of the project. (This study is due to official statistics until December 2017, because 2018 statistics are not yet reported by government agencies).

The U.H. Bosques de San Sebastián served as a fundamental basis to have an estimate of the total amount required to carry out the implementation of the measurement modernization at the national level. The CFE reported that it has 43,059,956 low voltage electric power users throughout the country in the Mexican territory, with this data we can make an escalation of the final price that this modernization will have, shown in the following table.

Average cost in the modernization of 4000 meters	\$ 6,570,669.29
Average cost in the modernization of 43,059,956 meters	\$ 70,733,179.5076

Table 2 Inputs needed to change digital meters nationwide
Source: Self Made

The first hirings assigned since 2012 must be taken into account, which were mostly tendered by the IUSA company. These were divided into two contracts with a total of 34 million 750 thousand 639 meters throughout the country with a settlement of total installation by the end of 2016. However, this was not achieved and in June 2017 an advance of 73.77% and 21.5% was reported, which led to a new estimate of the total number of meters to be changed. Which were subsidized by the federal government in conjunction with the CFE, although it is well known that the cost of the work published over time will be covered by users according to current regulations.

Discussion of results

The users reply that in their assessment after the transition of the change of meters, the digital meter increased the economic amount of the energy consumption to be paid with respect to the historical amount made in electromechanical meters (Lázaro, J. 2018).

Therefore, the reaction is immediately inconformity, arguing that it is a theft by the "unjustified" increase and do not consider that the possible causes of economic growth are due to: change of tariff according to consumption, supply and demand, increase in cost per kWh according to the season of the year, gradual payment of the cost of the meter.

For this reason users with the analog measurement system are also affected in the increase of consumption based on these parameters.

A great unknown of the user of the CFE is to know if at the end of the day the meters will be paid by the consumer and these will be the property of the user or CFE.

The previous regulations established that the meter was paid by the user that by law this is part of the infrastructure of the CFE, which was not modified from the energy reform, and therefore it is still taking the previous regulations (Energetic Reform, 2013).

A comparison between the electromechanical and digital meters identifies that the accuracy of the measurement in the digital meters has an error of $\pm 0.5\%$ that can be attributed to different types of faults (faults to earth ground, overvoltage, magnetization) which are reflected in the consumption in kWh. In the case of electromechanical meters faults could pass imperceptibly due to measurement error.

An advantage of digital meters over electromechanical ones is the accuracy of the consumption signal frequency. If it is considered that the charge of the electric power measured in kWh corresponds to the registered peaks of greater current amplitude of the consumption spectrum by the supply voltage in low voltage. What places the digital meters as the most accurate relating to a fair charge for both parties (the user and the CFE).

The loss of the subsidy to the electric power service due to the extinction or replacement of the CFE and supply by foreign companies to the low voltage energy sector from the energy reform would represent a series of social and economic problems for the population, in addition to a danger for Mexico and the Mexicans in the next generations.

Future works

A new project called Escalation of the measurement will be next in the list of pending projects that will continue in the modernization of the measurement. In this project it is planned to completely automate the connection and disconnection by satellite systems of the electricity supply based on its payment control, thus avoiding the taking of readings in a common way, increasing CFE's profit capacity, converting it into a competitive world class company.

This leads to a new unknown. What will happen to the workers in the measurement department? It is planned by the CFE that employees in this area will be relocated in other areas of the same, looking for this to be a more competitive globally with tendencies to overcome the competition that may originate the stay of foreign companies in the country according to the energy reform.

This will allow the CFE to keep the subsidies for the low voltage sector allowing thus improve the quality of life of Mexican families.

Conclusions

The modernization of the low voltage measurement system in the Mexican territory was accompanied by advantages and disadvantages under an empirical comparison of the modern measurement system with respect to the one implemented in the country, causing a repercussion in the socioeconomic, cultural and service environment.

This led to problems such as the opposition of users to the change of the measurement system, which caused riots, myths and social movements, attributing the new measurement system to be implemented is not reliable in the measurement, which generated rumors in Mexicans.

For this reason some hypotheses of the modern systems of erroneous measurement were made as they are previously programmed to increase the energy consumption, however this new measurement system is previously tested by the equipment and materials testing laboratory (LAPEM) in which the measurement equipment passed through a calibration process ensuring its proper functioning in the laboratory and in the field, with the possibility of belonging to the prepaid or payment system at the cut-off date.

In the engineering analysis carried out it was found that the resistance to change is due to external factors that obey other interests and not precisely related to technological development. This total opposition puts the CFE in technological backwardness consequently to Mexico.

The CFE seeks with this modernization to be a more competitive company at a global level with tendencies to overcome the competition that may arise from the stay of foreign companies in the country according to the energy reform. This will allow the CFE to keep the subsidies for the low voltage sector allowing thus improve the quality of life of Mexican families.

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Ecological Museums: Sustainable tourism and restoration of biodiversity

Museos Ecológicos: Turismo sustentable y restauración de la biodiversidad

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Abstract

This transdisciplinary research promotes the restoration of biodiversity and tackling climate change through a critical museology that starts the inter-institutional development of a Network of Ecological Museums in Mexico, with an educational model with immediate action that acts on the basis of sustainable tourism, social entrepreneurship and cultural identity. The first case – Magic Town of Mazunte, Oaxaca - plans an archaeological/ecological museum that disseminates ancestral roots and regional biodiversity, to the Mexican people and international tourism. The museum will seek to promote ecological awareness in all social and productive sectors; and one of the fundamental strategies will be using high-impact spectacular exhibitions through multisensory exhibitions operated by mechatronics and clean energies within an ecological-demonstrative architecture. The museum will promote the restoration of ecosystems through ecological engineering that allows the cultivation of regional domestic flora for diverse markets, with community economic benefit, and through preservation strategies that encourage the protection of local fauna on earth/coast/sea. It will have cybernetic educational technology to widely extend free environmental instruction; in addition, it will have documentation centers, eco-technological training and civil protection in a region (until today) marginalized and with high social risks due to the threat of natural disasters.

Ecotechnics, Mechatronic, Educational technology

Resumen

Esta investigación transdisciplinaria promueve restaurar la biodiversidad y afrontar el cambio climático mediante una museología que inicia el desarrollo de una Red de Museos Ecológicos en México, con un modelo educativo de acción inmediata que actúa sobre la base del turismo sustentable, emprendimiento social e identidad cultural. El primer caso –Pueblo Mágico de Mazunte, Oaxaca- planea un museo arqueológico/ecológico que divulgue raíces ancestrales y biodiversidad regional al turismo nacional/internacional. El museo promoverá la conciencia ecológica en todos los sectores sociales y productivos. Una de las estrategias fundamentales será realizando museografías espectaculares de alto impacto a través de exposiciones multisensoriales operadas por mecatrónica y energías limpias dentro de una arquitectura ecológico- demostrativa. Aunado a ello se busca que el museo promueva la restauración de los ecosistemas mediante ingenierías ecológicas que posibiliten el cultivo de flora doméstica para mercados diversos en beneficio económico comunitario, y mediante estrategias de preservación que exhortan la protección de la fauna local en tierra/costa/mar. También, contará con tecnología educativa para extender ampliamente la instrucción ambiental gratuita por Internet; además, tendrá centros de documentación, capacitación ecotecnológica y protección civil en una región (hasta hoy) marginada y con altos riesgos sociales por la amenaza de desastres naturales.

Ecotecnias, Mecatrónica, Tecnología educativa

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Introduction

Undoubtedly, global warming and climate change with rising sea levels, pollution and acidification of the oceans, together with the massive destruction of ecosystems and the decrease of natural resources due to the exponential growth of the population with human activities expanded as never before, is a problem of global magnitudes that is unprecedented in human history.

From the Industrial Revolution, the economy was suddenly driven by a production based on energies obtained by mineral and fossil fuels, before the scientific and technological expectations of that time to conquer an infinite planet, of immeasurable wealth and with vast natural resources; vision that today, almost two centuries of having started the process, has serious consequences for the balance of the biosphere, as it had never happened in the world for 65 million years (NatGeo 2016).

For the National Commission for the Knowledge and Use of Biodiversity (CONABIO 2006), the state of health of the Earth's ecosystems are extremely severe: half of the world's tropical and temperate forests disappeared, as well as half of the wetlands and one third of mangroves; 95% of large predatory fish have been lost and 75% of fishmongers have been depleted; 20% of the coral reefs disappeared and their degradation continues; the majority of semi-arid agricultural lands are very deteriorated and numerous toxic substances of the industry are found in the cells of our body.

The storage of fresh water doubled in the last 40 years, which represents more than 25% of the flow of all the rivers in the world, some of which no longer drain into the sea in periods of drought, in rivers so large in the past like the Colorado, the Yellow, the Ganges or the Nile.

Current energy production and transport use fossil fuels that emit 3,500 million tons of carbon per year in the stratosphere, which have caused, in a few generations, climate change with imponderable and perhaps irreversible consequences (CONABIO 2006, 8), at least for the next 10 thousand years (NatGeo 2016).

The future of the Earth is discouraging, mainly because of the goals imposed by all nations for sustained economic growth, with productive activities that increase energy demands (largely supplied by combustion) and increase pressure on natural resources, already devastated, in front of the unbridled population growth and the consequent pollution that do not grant any opportunity to the planet to recover on its own. Mexico is a megadiverse country and has a huge natural capital, therefore, it requires complex forms of use and management for the sociocultural and ecologically balanced development of the immediate future: our biological and cultural diversity requires great sensibility and social sensitivity with high resolute capacity before the complex conflicts that arise in the relationships of the components implicit in this challenge:

The challenges imposed by our mega diversity in national life are ignored or disregarded, which has led to loss or deterioration; the loss of our natural capital and the serious marginalization of important sectors of society, which are the owners of that natural capital -and that depend on it-, while also being the most marginalized from the socioeconomic point of view (CONABIO 2006, 9).

The misery in the countryside and migration, the lack of opportunities and the social repercussions of activities and the fight against organized crime along with erosion, soil infertility and depletion of fisheries, destruction of forests and extinction of unique species, are the conditions that prevail today as a result of our irrational way of life; situation that leads to having depleted, contaminated and overexploited ecosystems without the possibility of recovering. To face this biological-cultural reality of our country is to face our own commitment, responsibility and destiny before its enormous natural capital:

This is the heritage we must know, learn to manage sustainably and appreciate and preserve for the benefit of all Mexicans. This is not knowledge that we can import from other regions or countries; we have to generate it fundamentally in ours, with our own human capital. Ecosystems are not transportable from one place to another, as are the environmental services they provide or their biological diversity.

Both government programs and civil society must understand these ideas as a **priority of the highest hierarchy**, since they permeate day by day all aspects of the national economy, society and security. (*Id*, 11).

The management of biodiversity concerns a viable and competitive society with a sustainable material base that ensures the future of the country, with the survival of our biological and cultural heritage as part of the complex natural world:

In Mexico, there have been discrepancies and confrontations between development and efforts to conserve and sustainably manage ecosystems. It is time to assume that this should not be the case. Sustainable development implies a sustainable economic development with permanent social welfare, bounded by the environmental characteristics of each region (*Ídem*).

The research presented here is inserted in the National Development Plan of the Government of the Republic of Mexico considering the last axis of 5 main ones: **"Mexico with Global Responsibility"**. And under the goal of "strategies and lines of action" that has to do with *promoting the value of Mexico in the world, through economic, tourist and Cultural dissemination*. (PND 2013-2018).

Due to the above, our research takes strategies and actions to reverse this situation, changing the anthropocentric and sustained destructive development position at all costs for a holistic vision of the biosphere, with respect to nature through sustainable productive activities under the rigorous magnifying glass of the ecology and with economic benefit for the communities that apply them. We value and encourage the promotion of strategies that allow us to communicate and persuade the change of social vision by an ecological way of life, by means of spectacular and impressive museographies without losing the sense of cultural identity, which at the same time impact and impact directly - through the instruction- in sustainable economic and tourism activities to achieve balance with permanent restoration and conservation actions by the own communities that own each natural landscape: fundamental participation with substantial benefits without which it is impossible to face this great challenge.

Museums are means of education, transcendental communication and agile instrumentation to transform themselves into pioneering entities and agents that promote, speedily and interinstitutionally, social action responses that overcome the bureaucratized management of other instances and, also, complement and interact with the replicas of the Other entities dedicated to review, investigate and solve the problem of biodiversity in the 3 levels of government and in the international order.

Our proposal is based on a Critical Museology that analyzes current social problems to propose action strategies that give a new magnitude and meaning to the museum (Hernández 2006, 201), conceiving the museum space as an appropriate place to socialize knowledge with an interdisciplinary dialogue that generate new discourses for the society of the future (Santacana 2006, 19).

The **core** of our proposal is located in the natural / cultural / touristic heritage of the peoples that own the ecosystems, based on the territorial characteristics of each municipality, through multi-inter-transdisciplinary programs and strategies (science, art, technology, engineering, architecture, tourism, education, anthropology, sociology, philosophy, economics, museology, communication, among others) with governmental and international programs that intersect our **central object**: the regional heritage, with the sustainable tourism and economic links implicit in the environment of each project, to restore and conserve biodiversity by acting exemplarily through a museological **model** of community participation under the vision of social entrepreneurship that - once perfected - will lead to cover other regions of the country.

The **central problem** lies in creating intersectoral relations and communicative, educational, productive and supply conditions of products and services needed in local communities to work in favor of biodiversity, to restore and conserve it permanently without detriment to regional social improvements.

Our **hypothesis** establishes that, only by communicating and persuading the public to become ecologically aware with a striking museology based on their own cultural identity, with a relational aesthetic that entails applying what is captured in the exhibitions through solutions of immediate application to productive, tourist activities and domestics with local and regional community economic development -validated by communication and instruction in the specialized ecotechnological centers of the museum and other institutions, with the opening of possible markets to market the regional sustainable products and services that the community will offer-, will be counted with a solid platform to guarantee the restitution of biodiversity by the community itself, giving continuity through its traditional governance (uses and customs), overcoming the periods of the transpolitical administrations in the 3 levels of government and, consequently, re to support continuous inter / national scientific support, since the problem is endogenous and at the same time globalized.

This article describes our approach with the first case study: Magical Town of Mazunte, Oaxaca.¹ Then he explains the development of the research through the following sections: 1) **Museological Model**, which establishes the foundations of a Network of Ecological Museums in Mexico; 2) **Multisensory Museography or NeoMuseography**, as a powerful communication tool for museums as well as for Communication and Educational Technology; 3) **Mazunte Museum**, describes the Museum's vision and goals in relation to the ecosystems that must be met in its municipal territory; 4) **Educational Technology Units**, as a free dissemination strategy for the entire regional population; 5) **Value and Use** with the Policies of the international letters on the patrimony; 6) **Requirements of the public building** before the threat of earthquakes and cyclones, as well as exemplify the ecological architecture that will distinguish it. Then mark the 7) **General methodology**; 8) **Conclusions** that indicate the progress of this project and, finally, the acknowledgments to various people who favored and promoted this proposal.

¹ Oaxaca, State of the Republic of Mexico, located southwest of the national territory with coasts towards the Pacific Ocean. This State considered to be the most biodiverse in the country.



Figure 1 and 2 Marine species that inhabit the beaches and coast of the Mazunte region, Oaxaca, in Mexico
 Author: Juan Eduardo Cruz Archundia (JEC) 2018

Approach

In this section we consider the elementary information to think and consolidate an Ecological Museum in the "Magical Town"² of Mazunte, with a model of education and social action that elevates the ecological conscience as a way of collective life, which promotes ecotechnics to reduce pollution, protect ecosystems, conserve and restore biodiversity with community benefit through sustainability, in addition to helping to reverse global warming with actions in productive activities and services as well as in domestic uses, tourism and civil protection. It means a look at the regional panorama with data from 2005-2010, a review that is guided by the formula of *entrepreneurship-social / community / investment* itself that is cited in an article on this topic (Correa 2015) in order to modify social attitudes in favor of the planet.

² It is called "Magical Town" as a distinctive of the Government of the Republic for purposes of cultural tourism promotion of peoples with great cultural and architectural background in the country. Created in 2001, to date has been awarded the badge for 111 towns in Mexico.

This is an initial reference to capture the municipal environmental problem and to visualize the conflictive relationships of its economic activities and social actors, as well as to ratify the viability of the Museum in the town of Mazunte (due to its strategic importance in the Puerto Escondido-Huatulco tourist corridor or "Ribera Oaxaqueña", who has a link with the tourist corridor of the coast of the State of Guerrero) to make decisions that consolidate a plan that activates the initiative of the Museum Preliminary, with the approval of the Council of the Magical Town³ so that, with their collaboration, the executive project will be developed during 2018 and, then, during 2019-2021, carry out the respective intersectoral procedures to achieve it.

Mazunte had 873 inhabitants in 2010 (9% of the municipal population) and belongs to the municipality of Santa María Tonameca (24,318 inhabitants) where 22% were economically active and 12% were illiterate; the municipality covers 0.5% of the state territory with 49,739 hectares, it is a rural region with 89 communities 7 police agencies, 2 municipal agencies and 1 head. 26% of the population is indigenous, mainly Zapotec; It also has Afro-Indigenous (Abajeña) population, which is why it has a great cultural diversity. Its relevant activities are: tourism, agriculture, livestock, fishing, forestry, aquaculture, conservation of natural areas and protection of species (Correa 2017a, 1).

In this sense, during the talks with community leaders, the topic of economic activity was relevant, since, despite being a world-recognized tourist center, job opportunities are limited for the inhabitants. Because of this, they welcome our initiative.

Its orography gives the municipality of Santa María Tonameca a great wealth of ecosystems and biodiversity ranging from forest, pasture, deciduous and semi-deciduous tropical forests and low plains with rivers, wetlands and lagoons to coastal areas and oceanic areas.

³ The council of the Magic Town is made up of people of recognized moral quality, assuming responsibilities to promote, conserve and disseminate the traditions of their peoples. They are original and recognized as leaders of their own communities.

In addition, it has a protected area by the National Commission of Protected Areas (CONAMP) in the Mexican Center of the Turtle and also other Areas Voluntarily Destined to Conservation (ADVC) by the inhabitants (Correa 2017a, 8).



Figure 3 Orography and sea of the Mazunte region, Oaxaca, in Mexico

Author: JEC, 2018

The CONABIO (2008) points out that because the ocean zone is connected to terrestrial ecosystems along the coastal zone and also to rivers and various runoffs, marine ecosystems have an immense biological diversity structured by physical, chemical interactions, geological and ecological that provide abundant goods and services for social development and are essential to maintain life on the planet.

However, these ecosystems are finite and vulnerable to over exploitation and bad practices in productive activities, therefore, it is necessary to reformulate them to clean, conserve and restore coasts and oceans so that they are healthy and preserve their biodiversity:

The seas and the coastal zone of Mexico are one of the pillars for national development. Unfortunately, environmental deterioration, with the consequent loss of marine biodiversity and many socio-economic resources, continues to increase every day.

Our country is currently one of the most fragile marine ecosystems vulnerable to the impacts of natural and anthropogenic phenomena. Unfortunately, until today, our country has not integrated or adopted responsibly the principles of sustainability (CONABIO 2008, 156).

Mazunte is a favorable place to face this ecological challenge due to its rural and multicultural category, as well as the national and international tourist flow and for being a strategic point that associates in its coastal zone diverse ecosystems and that, in addition, has areas of conservation and municipal ecological ordering. CONABIO highlights the emergency of serving coastal areas:

Coastal ecosystems are the most threatened by anthropogenic activity, due to the effects of industrial, agricultural, tourism, fishing and mining activity, and the discharge of urban waste, sewage and hazardous industrial waste. Wetlands in this area, for example, are among the ecosystems most affected by human activities, both directly and indirectly. This affectation is leading to a loss of environmental services of great importance for society. Deterioration trends are increasing and the measures taken are still insufficient.

The most contaminated ecosystems are in the Gulf of Mexico region, however, the coastal regions of the Pacific are seriously threatened by the unsustainable development (tourism, industry and aquaculture) that is occurring throughout the Mexican coastline.

In addition to the local or regional impact, there is now the threat of potential climate change, whose effects (warming and sea level rise) will affect all coastal ecosystems. **It seems that the coast of Mexico is dying silently, without the political will or social participation can stop this deterioration and possible loss** (CONABIO 2008, 128).

This alert call, issued 10 years ago, must be attended urgently to address the anthropogenic and conservation problems that afflict the Pacific area of Oaxaca, starting with the first museum in the Magical Town of Mazunte, which already has a State Ecological Law and a Municipal Ecological Ordinance (SEMARNAT 2011).

Museological Model

The Mazunte Museum stands as an indeterminate entity that will highlight the prehistoric and ancestral origins of the region and its relations with the environment, that is, with its natural landscape.

On the other hand, the investigations of the National Institute of Anthropology and History (INAH) that will be developed in Punta Cometa, recently declared as an archaeological zone, also serves as a convening entity among the local population to study and disseminate it.

In addition to recovering and cataloging the pieces scattered archeological; at the same time that the Museum will disseminate the biological wealth of the State of Oaxaca, the entity with the greatest biodiversity in Mexico (the country that occupies the 4th place in the world), and will disclose the current seriousness about the deterioration of the biosphere on the Pacific coasts South with meteorological threats and global warming, dangers that require providing long-term solutions to achieve social change and foresight to build a viable future for its inhabitants.

Therefore, here is proposed a museological model that articulates the dissemination of local cultural identity and regional ecological problems with research, technologies and social actions that will help address them, through *identity / knowledge / community / investment / entrepreneurship* where policies on development will provide the initial *government-private-international* investment for the community to carry the destinies of a long-term visionary model, with an economic perspective that grants permanence to the project and guarantees protection to the biosphere.

The aim is to overcome the political transitions that arise in the administrative exercises of the federal, state and municipal governments.

This statement is based on the consideration that a municipal museum requires at least 3 years to establish itself, 2 more years to stabilize and then, from the sixth year, consolidate and project in the long term; hence the need to have a strategy to overcome the aforementioned transitions. Social entrepreneurship will contribute - through continuous economic action with clearly defined environmental and environmental objectives - benefits to the community, tourism and biodiversity.

Conceive social entrepreneurship, as a museum vehicle that allows to overcome the transpolitical and administrative periods in the three levels of government for the execution of projects of community and environmental benefit, with a strategy that guides the efforts to produce jobs and self-employment with sustainable economic development, besides governing the activities with a vision of self-financing and community economic growth, it opens a door to transcend the governmental paternalism that historically has seen its social perspectives truncated at the end of its cycles.

The social enterprise proposed here is governed by a museological horizon that sees economic development with benefit in cultural and biological diversity through sustainability (opposed to the business sector that sees capital accumulation as its sole purpose), it offers another possibility to develop this type of projects.

It is a mutant museum model, that is to say, a model that transforms in time to achieve its ends, passing the post between each of the agents involved during its different stages, which makes it a viable strategy.

The development phase is in the management stage of the executive architectural project, is on track and has been accepted with pleasure in the preliminary work by the community.

Starting in 2019, the building, assembly, training and operation of the museum will be managed to implement the general plan, tentatively in 2021, with an economic logic that highlights, at first, the possibility of carrying out dissemination efforts from receive income to address the identatary / ecological problem; that is to say, "to be able to live" of the activity with which the own sustainable future is constructed.

Thus, people will be able to specialize in this type of development from the perspective of entrepreneurship that provides social benefit, while consolidating identity and solving environmental problems. It is a scheme that can be reproduced in other regions of the country with promoters from the same communities of Mazunte.



Figure 4 Aspect of the landscape and architecture in conjunction with the beaches in the Mazunte region, Oaxaca, in Mexico.

Author: JEC, 2018.

The model has an ambitious horizon, by integrating four social objects:

- a) *Heritage Registry*: Heritage documentation, both archaeological, historical and cultural as well as natural, agricultural and productive of the municipality to offer a coherent museal offer between identity and sustainable tourism with a sustainable regional economy.
- b) *Cultural infrastructure*: it builds a museum building as a permanent community enterprise that enhances the Mazatlan identity and allows the preservation of ecological wealth, as well as disseminating the natural / material / immaterial cultural richness of the region; with strategic support between museums and diverse spaces of socialization and dialogue to stimulate the social and tourist exchange of traditional knowledge and identities with biological engineering and ecological sciences.
- c) *Cultural expression*: disseminates scientific knowledge and traditional knowledge through talks, conferences, courses and workshops; presentation of books on archeology, history, art and science, the biosphere and ecotechnics; promotes related topics through literature, painting, sculpture, multimedia, video art, short films, performance, photography, music and projection of artistic or documentary events and cultural or sports television programs to enhance identity and promote the socialization of knowledge in the museum.

d) *Economic development:* investigates, promotes and trains on the use of ecotechnologies to restore and protect the coastal ecosystems and marine areas of the municipality, with its application in tourism, domestic and sectoral activities -in congruence with their uses and customs- to expand the offer economic and employment with ecological awareness with the production of goods and services through the opening of financing and markets specialized in sustainability.

The scheme is formed by two axes: heritage / tourism and identity / economy, in which the policies of community benefit are based on their respective tasks.

Here the organization sees the museum as an articulator and promoter of social action that leads to the consolidation of cultural identity and regional benefit.

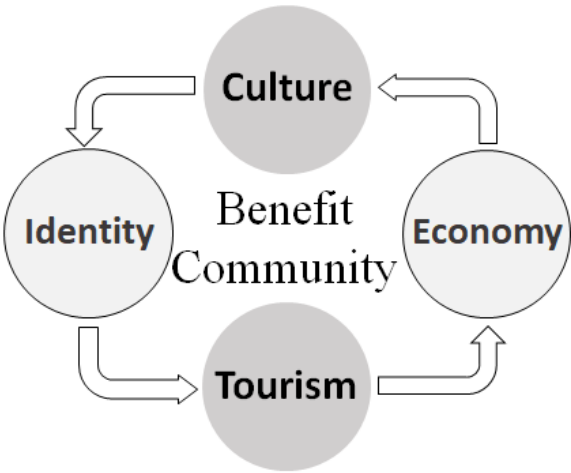


Figure 5 Scheme of components for social benefit
Author: Miguel Ángel Correa Fuentes (MACF), 2015

The general order is conceived based on a central conceptual core-the Mazunte Museum-that articulates its social functions before the regional heritage with economic sectors and inter-institutional relations related to culture, history, science and technology, which constantly nourish the topics that the museum should disseminate, with an interaction that adapts to diverse social changes over time, as well as identifying and addressing the opportunities, frailties and threats that affect every society.

Thus, the museum will become an institution that allows the articulation of the dissemination of awareness and ecological awareness with long-term community development, through an economic scheme based on entrepreneurship that serves as a pillar and driver of social benefit with the consolidation of identity, as well as the preservation of the cultural and biological diversity of the region, promoting cultural tourism with community integration that includes festivities, routes, sites, material and immaterial production, protection of ecosystems and species -among others-, in a productive cycle related to sustainability.

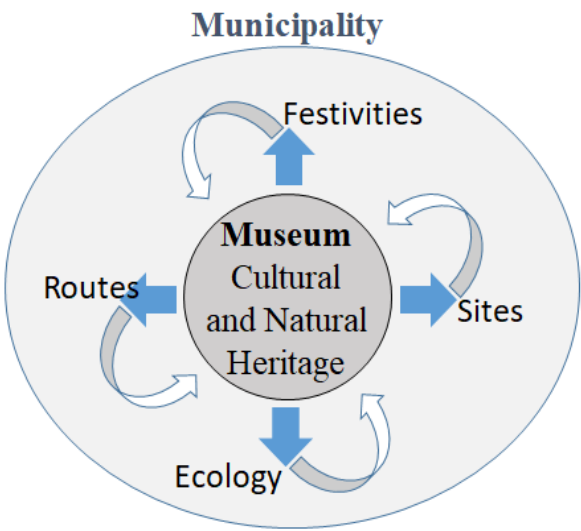


Figure 6 Outline of cultural organization of the Museum in the municipality
Author: MACF, 2015

Multisensory Museum

A museum that deals with research, protection and awareness about identity, prehistory and ancestral past, about the biosphere and global warming, as well as local economic conditions to disseminate the necessary ecotechnologies and respond fully to these problems, can not omit social participation , that is, to be inclusive with all social sectors, since without it, museum institutions will have limited influence on the fulfillment of their social functions, as well as being a fundamental right for every community.

This is vital, because most of the world's biodiversity is not found in protected and monitored reserves, but in landscapes managed by the communities that inhabit them.

Much of the world's biodiversity is managed by marginalized traditional groups, which is why the dissemination of identity and ecological awareness through museums should make it clear that the process of reception / understanding / ecological assessment / conservation in these spaces has that incorporate the substantial idea of including and benefiting these groups.

Starting from this precept, the educational axis of the museological model requires to be mediated by a relational aesthetic, that is, by a museography that impacts the visitor, giving importance to the relationships it establishes with the public, which is designed as a process oriented towards educational actions through the apprehension of immediate practical applications for daily and productive life. This guiding axis considers the public not as a receiver but as an interactor and creator, since each archaeological and ecological concept captured in the exhibitions must form a material for people to produce immediate and tangible actions in favor of the environment and identity. Then the museum is considered as a "living" center, captivating and motivating effective initiatives to be applied by residents and national and international tourists.

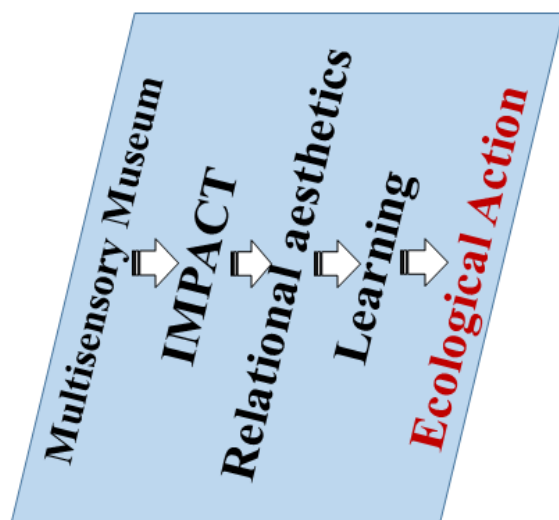


Figure 7 Diagram of the educational axis with ecological Action

Author: MACF, 2018

On the other hand, a museological project that addresses social identity and ecosystems requires technological representations rather than collections.

That is, technical resources can motivate the pride of ancestral origin, its rituals and worldview in connection with nature to explain entities biological systems integrated by a set of interrelated living beings in a given world, all in a fragile balance of diverse complexities that, together, make up the hypercomplexity of the global biosphere.

Therefore, mathematical models, statistics, metaphors and other literary figures, virtual simulations and interaction - through various intelligent technological resources and with different modes of representation - will be the substantial vehicle to develop emotive museographies that expose complex concepts of the relations between the open systems that integrate the biomes, between the relations of Physics and Chemistry with Biology, between the relationships of Biology with Archeology and Anthropology with ancestral rituals and traditional knowledge, with Sociology and Economics, and Ecotechnics. That is to say, it is required to go beyond the exhibitions sustained in the exhibition of historical objects or species.

For its part, an inevitable component in the dissemination of archaeo-ecological museums is to disseminate scientific research on the past, the biosphere, the environment, sustainable development and ecotechnics, both for tourists who attend the exhibition spaces and for the communities that participate in them and coexist in the region.

The promotion of this research will allow the museum to establish alliances with national and international institutes dedicated to these activities to disseminate them, fostering an instrument of development in the communities with a favorable impact for the identity and conservation of biodiversity.

The museography of museums that disseminate theories, concepts and identities requires powerful communication techniques that lead to representing the meaning of "what is proper", protecting biodiversity, that is, it requires the visitor to be immersed in the guardian thoughts of life and identity with experiences that provoke metacognition (exploration and physical interaction with global thinking and parallel knowledge, development of multiple intelligences, embodied imaginative comprehension and significant spatio-temporal learning).

The proposed NeoMuseography has its orbital axis in the concepts of multisensory image and technology as vivifiers of a holoperceptive language that submerges the public in an immersive / interactive / participative aesthetic and pedagogical process that introduces it -both body and mind- into one's own representation to grant him presence in the theme staged before him, a process that communicates and makes it possible to build identity and knowledge through enunciative techniques with signs, data, symbols, forms, photos, objects, paths, spaces, stimuli and emotions; which encourages the public, as a spectator, to become an explorer, actor, interactor and intellectual discoverer of the world of knowledge represented before him.

The technical resources that will make it possible resort to the use of museographic interfaces that allow identifying attitudes and situations through multimodal commands (oral, corporal and gestural) to give answers through designs of Mechatronic Engineering (discipline that integrates electrical, mechanical engineering, electronics, robotics and computer science to develop control systems that allow the design of intelligent processes), mediated by interactive scenic strategies to create emotive dialogic atmospheres, according to the nature of each expository topic.

The techniques that will make it possible are digital and analog audiovisual and interactive systems; animation, virtual reality and augmented reality; sensor automation, robotic lighting and stage control and internet; production, propagation and control of aromas / flavors, vibrations / sounds, as well as effects of special sensations, such as psychoacoustics, to intensify the museal significance in their exhibitions.

This new museography is potentially powerful and should contribute to generating changes in society through an integrating vision that develops an awareness of environmental and identity through experiential, interactive and imaginative exhibitions that lead to the understanding, appreciation and respect of cultural and biological diversity own with creative actions in the integral and sustainable management of expressions, resources and landscapes of each community.

In order to show them to the regional, national and international public, and contribute to social cohesion and environmental education, developing exhibitions that motivate initiatives of protection, rescue and conservation of environmental systems and social expressions to train generations of humans who respect life and the culture.

The exhibitions should be based on the diverse conceptual and conceptual experiences through technological art, showing the public the social "belonging" and the "fragility and complexity" of the relationships between the components that integrate society and ecosystems, favoring that contents of the exhibitions are applied to a direct and immediate use to influence the daily life and productive activity.

Besides spreading and promoting the application of clean technologies - developed in the country and in the world - to promote the protection and restitution of flora and fauna in regional ecosystems with the support of social networks to massify the initiative.

NeoMuseography will approach the concept of identity with perceptions that highlight the ontological landscape of Mazatlán based on the value of their ancestral customs of community collaboration compared to other ways of understanding social relationships; and on the other hand, it will approach the concept of life entering sensorialisations that explain the complex relationships between plant and animal beings interrelated in an environment with different levels and dimensions, as biological groupings that integrate open systems where each individual is independent but at the same time subject of other living beings and the mineral, geographic and climatic context they share; located in territories where each individual establishes a relationship in balance with the rest, in a fragile and harmonious interdependence that allows the development of life from the simple assemblies, which are added gradually to travel through the complexity of ecosystems and biomes until we reach planetary hypercomplexity.

In this way, the disciplines that intervene in the cognitive process to capture the complexity of the biosphere and the relationship of man with it, are added starting from those that study matter and energy, then those that deal with knowledge about life and finally those that approach the anthropogenic study in a profuse branch of specialties that communicate -in different degrees- the subjects related to biodiversity, culture and economy. In this way, establishing museum units in each type of environment, places us in the context we want to address, submerging the museum spaces and visitors in the own ecological and cultural scenario, with all its components and relationships.

This is how NeoMuseography deals with the systemic relations that the human eye can not perceive at a glance in the environment in question, in a game of artistic and technological possibilities to educate and motivate the public with immediate collaboration initiatives to preserve the cultural and biological diversity, highlighting that one of the main purposes is that the visitor acquires respect for nature and for all life on our planet, since human beings are part of it.

This new museography is based on the conception that the public is the creator of the experience, where the exhibition concept enters fully into the territory of the sensoryization of playful and interactive knowledge that creates astonishment in the visitor and produces creative and active reactions in he, in a display of pleasure and social commitment to consolidate the identity and protect what we observe in the museum environment. Art, play with multimodal interactivity and multisensory pleasure, exploration and discovery, meaningful learning and social commitment, are the elements that underpin the neomuseographic concept of ecological museums, encouraging the public to understand that the exhibitions they explore are an incomplete puzzle and that he it is the missing piece to complete the aesthetic / pedagogical experience

It is of fundamental importance to integrate the public as protagonist and main responsible of the cultural / ecological adventure where systems and subsystems have modifiable relationships, highlighting that the misuse of nature goes against oneself and damages the livelihood of humanity.

It is here that the concept of relational aesthetics explains the dynamics of the sensory experience proposed, understanding it as the immediate and conscious experience of oneself, as an active creative agent of an effect and its repercussions. This definition focuses on the final aspect of the neomuseographic concept: the evidence of the consequences that our actions motivate to reflect on them, is the fact of being aware of the multiple possibilities that triggers one or the other decision within the system, where the protection of the environment is a matter of decision, with the consequent instruction: "learn to decide correctly" (Museística, 2010).

The management of the institutional image of the museum will project boasting of biodiversity with technological cleanliness and social participation as a focus of action. The exhibitions will be large enough to allow visitor mobility and encourage exploration and intellectual and sensory discovery. The selection of recycled and biodegradable materials, as well as the application of technologies and clean energy in the construction and operation of museographies and operation of the museum, will be fundamental for the proposal to be consistent with the protection of the environment.



Figure 8 Location of the communal property "Casa del Pueblo" destined to build the Museum, where the proximity to the Punta Cometa Archaeological Zone is shown

Image of Google Earth, 2018. Edited by authors

Mazunte Museum

We think with a Biocentric vs. Anthropocentric Philosophy, conceiving a humanity in harmony with the environment through a different kind of consciousness in front of the biosphere, not of imposition but of preservation and balance, through a holistic understanding of the world, understood as an open and complex network of multi-dimensional systemic relationships where humanity is "only" a fragile component.

The museum is based on the consolidation of local cultural identity with a philosophy that promotes a humanity in harmony with nature and society, a non-destructive or dominant culture that preserves the world and ancestral history through a worldview that is understood as an open and complex network of multi-dimensional systemic relationships of planetary life and culture. Next, the constitutive criteria of the museum entity are established:

Vision: The museum contributes to generate identity and-together with other educational, technological and economic cooperation instances-changes in society through an integrating view man/nature to develop an environmental cultural awareness through living and immersive/interactive/participatory museums that lead to the understanding, valuation and respect of the identity with local ecosystems and biodiversity through creative community actions in the integral and sustainable management of the resources and landscapes they inhabit.

In order to show them to the regional, national and international public and contribute to education and environmental restoration of the planet.

Mandate: Develop an enterprising and enterprising attitude in the municipal population to preserve ancestral culture and restore biodiversity, with an educational sense based on a relational aesthetic; by building museum spaces that exalt local pride for their traditions and illustrate the immediate application of ecotechnics in all human activities, with the wide dissemination of research on prehistory, archeology and ancient history, the biosphere, the environment and development that propicien a healthy ecological conscience for the daily life and the productive sector of the region; through a sustainable development in accordance with the priorities of the communities that orbit around the Mazunte Museum, in a democratic and respectful relationship of cultural differences in biological diversity that encourages and protects the natural heritage to enrich the economic and multicultural life of Oaxaca.

SUPERIOR PURPOSE: Exalting the identity with the ancestral origins of the region, as well as restoring, preserving, conserving and protecting the biodiversity of Oaxaca, through a sustainable economic and tourism relationship with the growing application of ecotechnologies.

General objective: To disseminate an education that motivates, trains and stimulates domestic and productive actions aimed at awakening the ancestral identity and history and the awareness of the use of ecotechnologies for the conservation of biodiversity and environmental products / services in the long term, with the improvement of the living conditions of the local population through sustainable social entrepreneurship.

Specific objectives:

- 1) Exalt local identity and ecological awareness through museum spaces operated with ecotechnics and with the design of museographies based on technological art to sensorialize ecosystem relations and capture their complexity.
- 2) Build scripts and content according to the ecosystems and archeology of the municipality of Santa María Tonameca and in accordance with the priorities of their communities.
- 3) Conduct studies to develop social communication and marketing strategies for cultural and ecological tourism.
- 4) Establish links with research centers on history and archeology, the biosphere, studies of the environment and sustainable development, as well as institutes that develop ecotechnologies to apply them in the spaces destined to erect and operate the Museum.
- 5) Establish models of collaboration and financing among specialists, government entities and local and international communities to provide continuity to the purposes of identity and conservation of the municipal ecosystems involved.
- 6) Promote sustainable tourism projects and archaeological and ecological research for the sustainable economic development of the region.

7) Establish participation links with local, state, federal and international cultural authorities.

8) Build the Master Plan of the Museum, as well as create education, training and exchange programs for the communities involved in the project.

9) Form a Training and Liaison Center that promotes, trains, distributes and manages the application of eco-technologies to restore and conserve municipal biodiversity, according to the Ecological Ordinance of Santa María Tonameca 2011 in its 22 environmental management units, and in relation to the richness of the flora and fauna of the region, as well as the endemic species and other varieties protected by the Official Mexican Standard, in accordance with the following priorities:

A. Preserve / preserve / protect flora / fauna: 9.1) Mangrove (coastal lagoon system) 9.2) Coastal sand dunes 9.3) Riparian vegetation 9.4) Non-fragmented forest cover 9.5) Natural water bodies

B. Restore fragmented vegetation cover and degraded soil with its fauna: 9.6) Jungles (medium and low, deciduous and subcaducifolia) 9.7) Mangrove 9.8) Scrub 9.9) Coastal dune 9.10) Grassland

C. Promote agricultural production, financing routes and open markets compatible with natural and processed products of local ecosystems: 9.11) Food crops, fibers and ornamentals 9.12) Aquaculture with local species 9.13) Conservation and rearing of deer, iguana and other species 9.14) Products timber

D. Disseminate freshwater and saltwater purification methods, as well as procedures to trap carbon dioxide from the atmosphere and reduce the emission of greenhouse gases.

E. Promote the recycling of garbage for construction, usable in roads, dikes and various buildings, as well as fertilizers or domestic and tourist energy applications.

F. Encourage the development of runoff cleanup and conservation programs.

G. Train and provide products and services to implement clean photovoltaic, wind and other energy in the region.

Educational Technology Units

The Mazunte Museum will not only be made up of exhibitions in its building, it will also include external units throughout Tonameca, strategically located, as well as in other archaeological sites, in places where species are protected and also in other related instances (such as the Centro Mexican Turtle, University of the Sea or INAH, for example). That is, by "stations" with WEB link for the visitor to explore and capture information on site - through mobile technology- with "backpacking" routes through the municipality, through the design of Learning Units (or communication and technology environments) educational to learn at any time and anywhere) to highlight the identity of the Mesoamerican past, and train for free on various productive issues, ecological techniques and marketing to the entire population of the region.

The educational model of the Museum and its Learning Units complement each other, it is a concept that integrates neomusopographic communication and educational technology with the Web to disseminate culture and biodiversity:

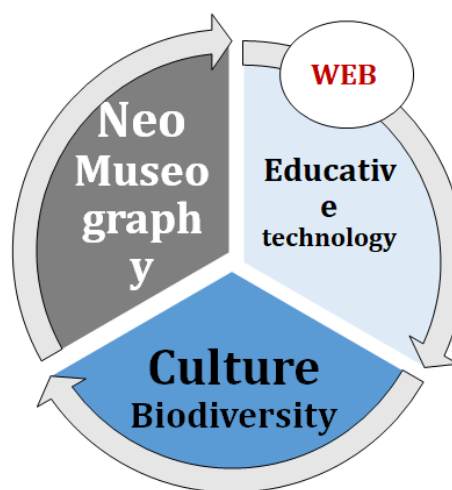


Figure 9 Educational model of the Museum
Author: MACF, 2018

Value and Use: Policies of international heritage letters

This research considers, in the same way, the international recommendations expressed in letters issued by NGOs from UNESCO and / or independently worked by specialists grouped in disciplines, concerned about situations and changes in the cultural heritage and its natural riches , its tangible and intangible cultural heritage including those considered mixed.

In this regard, since 1977 there were already concerns about the high levels of contamination in cultural heritage sites of the villages. This environmental pollution, which has worsened in unprecedented proportions, and potentially catastrophic as a direct consequence of the unplanned urbanization and the excessive exploitation of resources. (International Charter of Machu Pichu, 1977).

This document states in the area of natural resources and environmental ornamentation that "The official policies that regulate urban development must include immediate measures to prevent the degradation of the urban environment from accentuating and in turn achieving the restoration of the basic integrity of the environment, in accordance with the rules of health and social welfare". (*Ídem*). This international letter prepares the governments of the world with vast patrimony to face a dynamic of urban growth in medium-sized cities and towns, which encourages them to create plans and projects based on environmental considerations; Today the letter is still valid from a contextual approach that involves the environment, resources and cultural heritage of certain areas or regions, which must be managed responsibly and sustainably.

The Paris agreements allow us to consolidate research, on the one hand, on the theoretical and, on the other, the development of the community project: 195 countries met and agreed to mitigate **global warming by two degrees centigrade with respect to the pre-industrial era**. How? Reducing greenhouse gas emissions through mitigation, adaptation and resilience. The objective is specific to lower global warming rates, considering various strategies emanating from the current legislation of each country in accordance with these agreements, the support in a very particular way is based on the commitments of "**adaptation**" which establishes as an end to protect to people, livelihoods and ecosystems, taking into account the urgent and immediate needs of the most vulnerable countries, (Paris Agreements 2016), all ratified by the Government of Mexico as a great commitment.

In Mazunte, in particular, it is urgent to apply measures that encourage cultural identity and, through this, seek mechanisms to preserve and preserve natural and mixed environments, typical of the cultural identity of the people.



Figure 10 Natural and mixed environments in Mazunte, Oaxaca
Author: JEC, 2018

Public Building Requirements

The conditions of risk / fragility in Mazunte and the conception of the Network of Ecological Museums, impose the following criteria for its design and construction:

1. Seismic resistance at 9 ° Richter.
2. Endurance to hurricanes with winds over 250 km / h (Category 4), where the predominant direction of the breeze comes from the southeast.
3. Bioclimate for a cool temperature (20-25 ° C) in rooms and training center.
4. Photovoltaic energy self-sufficiency with day and night application.
5. Rainwater recovery.
6. Water purification for hygiene and food.
7. Recycling of wastewater.
8. Ecological architecture mimicked the environment by roofs with low forest cover, adhered to the Construction and Structural Safety Regulations of Mazunte.
9. Use of recycled materials and ecological materials for building.
10. Application of digital and analog technologies friendly to the environment.
11. Elevator for a rolling chair with a companion through a design consistent with the Construction Regulation.
12. Pedestrian access ramps with a maximum of 8 ° of slope.



Figure 11 Preliminary proposal in model of the ecological building

Design of female students of the Bachelor of Architecture of the UAEM: Hernández Enríquez, Diana Laura and Lárraga Peralta, María Fernanda. 2018

Methodology

1. Theoretical and proactive development.
2. Search of interested communities.
3. Link with viable communities: Mazunte
4. Management, approximation and presentation of the generalities of the project to the leaders.
5. Acceptance by the Magical Town Council
6. Museological and architectural preliminary project.
7. Acceptance by the People's Assembly and designation of the Monitoring Committee.
8. Development of the executive project.
9. Master Plan and inter-institutional links.
10. Financing.
11. Construction.
12. Start-up.
- ▼ 13. Valuation before the community, before or after the change of Traditional / Municipal / State governance.
14. Review of strategies with the community and correction of directions.
- ▲ 15. Operational continuity after the first political transition and subsequent (return to phase 13 in permanent review and adjustment cycles to give continuity to the mandate and fulfill the objectives of the Museum)

Conclusions

At the time of closing this letter, our project is in phase 8 (we started the executive project), which was approved by the community of Mazunte in its General Assembly on September 8, 2018, where the Monitoring Committee was appointed.

Now the executive project will be concretized, which will allow the community to request resources from different governmental and private entities -of the country and international- to begin construction during 2019, with the possibility that the Mazunte Museum will begin operations in 2021.

The development landscape is promising for the area, however, processes should be taken care of in the last stages due to the change of the Federal Government in transition during this 2018; Policies should not change, but they should adhere to 2019 guidelines and strategies of a new National Development Plan for culture, heritage and the environment of Mexico in its different regions.

We urge readers to identify with this proposal, to contact us to promote museums of this type in other regions of the country and to initiate an ambitious program for the construction of a "Network of Ecological Museums in Mexico".

Acknowledgement

We acknowledge different people and instances that have supported this investigation during the course of their proposal. We started with the altruistic support of Mario Alberto Correa Fuentes with travel expenses to carry out the initial reconnaissance and incursions during 2017 and 2018; Engineer Manuel Rodríguez Gómez (former director of the Mexican Turtle Center) for capturing the importance of the project and promoting it among the community of Mazunte; also to Victor Emiliano Álvarez Rodríguez, President of the Magical Town, for giving acceptance and viability to the project, adding to his management the support to host and feed the students of social service and Professor Dr. Juan Eduardo Cruz Archundia for the topographic survey of the property "Casa del Pueblo", land that was proposed for the realization of the Museum.

Also the director of the Faculty of Architecture Mtro. Adolfo Saldivar Cazales and the provision of teamwork and human and material resources of the Academic Body "Management of Tourism and Cultural Heritage", in the same way to the Degree in Tourism of the same Faculty and its director Dr. Gerardo Gama Hernández, all of them of the Autonomous University of the State of Morelos.

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Instructions for Scientific, Technological and Innovation Publication

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Abstract (In English, 150-200 words)	Abstract (In Spanish, 150-200 words)
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* Correspondence to Author (example@example.org)
† Researcher contributing as first author.

Introduction

Text in Times New Roman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

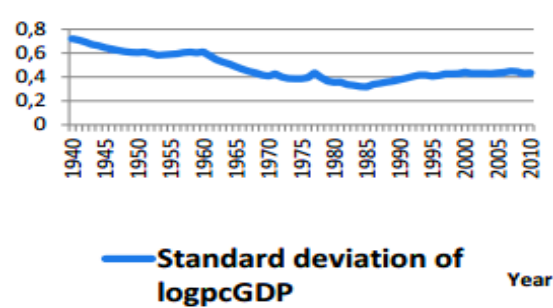
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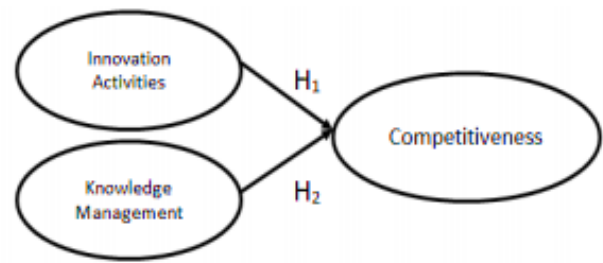


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LIQUIDITY	0.30333	-0.22337	-0.09989	-3.44381	0.54441
SIZE	0.43530	-0.17872	-0.60025	1.22512	0.77877
PROFITABILITY	0.51014	-3.48323	0.20618	-0.1863	0.02273

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Each Article shall present separately in **3 folders**: a) Figures, b) Charts and c) Tables in .JPG format, indicating the number and sequential Bold Title.

For the use of equations, noted as follows:

$$Y_{ij} = \alpha + \sum_{h=1}^r \beta_h X_{hij} + u_j + e_{ij} \tag{1}$$

They must be editable and number aligned on the right side.

Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

Results

The results shall be by section of the Article.

Annexes

Tables and adequate sources thanks to indicate if they were funded by any institution, University or company.

Conclusions

Explain clearly the results and possibilities of improvement.

References

Use APA system. Should not be numbered, nor with bullets, however if necessary numbering will be because reference or mention is made somewhere in the Article.

Use Roman Alphabet, all references you have used must be in the Roman Alphabet, even if you have quoted an Article, book in any of the official languages of the United Nations (English, French, German, Chinese, Russian, Portuguese, Italian, Spanish, Arabic), you must write the reference in Roman script and not in any of the official languages.

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