

Volume 7, Issue 12 — January — June — 2021

E
C
O
R
F
A
N

Journal-Republic of Peru

ISSN-On line: 2414-4819

ECORFAN[®]

ECORFAN-Journal Republic of Peru

Chief Editor

SUYO-CRUZ, Gabriel. PhD

Executive Director

RAMOS-ESCAMILLA, María. PhD

Editorial Director

PERALTA-CASTRO, Enrique. MsC

Web Designer

ESCAMILLA-BOUCHAN, Imelda. PhD

Web Diagrammer

LUNA-SOTO, Vladimir. PhD

Editorial Assistant

TREJO-RAMOS, Iván. BsC

Translator

DÍAZ-OCAMPO, Javier. BsC

Philologist

RAMOS-ARANCIBIA, Alejandra. BsC

ECORFAN Journal-Republic of Peru,

Volume 7, Issue 12, January – June, 2021, is a journal edited semestral by ECORFAN. La Raza Av. 1047 No.- Santa Ana, Cusco, Peru. Postcode: 11500. WEB: www.ecorfan.org/republicoferu/, journal@ecorfan.org. Editor in Chief: SUYO-CRUZ, Gabriel. PhD. ISSN-2414-4819. Responsible for the latest update of this number ECORFAN Computer Unit. ESCAMILLA-BOUCHÁN, Imelda, LUNA-SOTO, Vladimir. La Raza Av. 1047 No. - Santa Ana, Cusco-Peru. Postcode: 11500 last updated June 30, 2021.

The opinions expressed by the authors do not necessarily reflect the views of the editor of the publication.

It is strictly forbidden to reproduce any part of the contents and images of the publication without permission of the National Institute for the Defense of Competition and Protection of Intellectual Property.

ECORFAN Journal Republic of Peru

Definition of Journal

Scientific Objectives

Support the international scientific community in its written production Science, Technology and Innovation in the Field of Social Sciences, in Subdisciplines of business, administration-administrative, management-SME, management-tourism, hotel, management-financial, administration.

ECORFAN-Mexico SC is a Scientific and Technological Company in contribution to the Human Resource training focused on the continuity in the critical analysis of International Research and is attached to CONACYT-RENIECYT number 1702902, its commitment is to disseminate research and contributions of the International Scientific Community, academic institutions, agencies and entities of the public and private sectors and contribute to the linking of researchers who carry out scientific activities, technological developments and training of specialized human resources with governments, companies and social organizations.

Encourage the interlocution of the International Scientific Community with other Study Centers in Mexico and abroad and promote a wide incorporation of academics, specialists and researchers to the publication in Science Structures of Autonomous Universities - State Public Universities - Federal IES - Polytechnic Universities - Technological Universities - Federal Technological Institutes - Normal Schools - Decentralized Technological Institutes - Intercultural Universities - S & T Councils - CONACYT Research Centers.

Scope, Coverage and Audience

ECORFAN Journal Republic of Peru is a Journal edited by ECORFAN-Mexico S.C in its Holding with repository in Republic of Peru, is a scientific publication arbitrated and indexed with semester periods. It supports a wide range of contents that are evaluated by academic peers by the Double-Blind method, around subjects related to the theory and practice of Business, administration-administrative, management-SME, management-tourism, hotel, management-Financial, Administration with diverse approaches and perspectives , That contribute to the diffusion of the development of Science Technology and Innovation that allow the arguments related to the decision making and influence in the formulation of international policies in the Field of Social Sciences. The editorial horizon of ECORFAN-Mexico® extends beyond the academy and integrates other segments of research and analysis outside the scope, as long as they meet the requirements of rigorous argumentative and scientific, as well as addressing issues of general and current interest of the International Scientific Society.

Editorial Board

BARRERO-ROSALES, José Luis. PhD
Universidad Rey Juan Carlos III

MIRANDA - GARCÍA, Marta. PhD
Universidad Complutense de Madrid

BARDEY, David. PhD
University of Besançon

SEGOVIA - VARGAS, María Jesús. PhD
Universidad Complutense de Madrid

MIRANDA - TORRADO, Fernando. PhD
Universidad de Santiago de Compostela

GARCIA - ESPINOZA, Lupe Cecilia. PhD
Universidad de Santiago de Compostela

ÁLVAREZ - ECHEVERRIA, Francisco Antonio. PhD
University José Matías Delgado

DANTE - SUAREZ, Eugenio. PhD
Arizona State University

GÓMEZ - MONGE, Rodrigo. PhD
Universidad de Santiago de Compostela

D. EVANS, Richard. PhD
University of Greenwich

Arbitration Committee

CONTRERAS - ÁLVAREZ, Isaf. PhD
Universidad Autónoma Metropolitana

GAVIRA - DURÓN, Nora. PhD
Instituto Politécnico Nacional

GONZALEZ - IBARRA, Miguel Rodrigo. PhD
Universidad Nacional Autónoma de México

FORNÉS - RIVERA, René Daniel. PhD
Instituto Tecnológico de Sonora

MALDONADO, María Magdalena. PhD
Instituto Politécnico Nacional

CASTILLO - DIEGO, Teresa Ivonne. PhD
Universidad Autónoma de Tlaxcala

HERNÁNDEZ, Carmen Guadalupe. PhD
Instituto Politécnico Nacional

ELISEO - DANTÉS, Hortensia. PhD
Universidad Hispanoamericana Justo Sierra

GIRÓN, Alicia. PhD
Universidad Nacional Autónoma de México

GONZALEZ - GARCIA, Guadalupe. PhD
Universidad Autónoma del Estado de México

ARRIETA - DÍAZ, Delia. PhD
Escuela Libre de Ciencias Políticas y Administración Pública de Oriente

Assignment of Rights

The sending of an Article to ECORFAN Journal Republic of Peru emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Originality Format for its Article.

The authors sign the Authorization Format for their Article to be disseminated by means that ECORFAN-Mexico, S.C. In its Holding Republic of Peru considers pertinent for disclosure and diffusion of its Article its Rights of Work.

Declaration of Authorship

Indicate the Name of Author and Coauthors at most in the participation of the Article and indicate in extensive the Institutional Affiliation indicating the Department.

Identify the Name of Author and Coauthors at most with the CVU Scholarship Number-PNPC or SNI-CONACYT- Indicating the Researcher Level and their Google Scholar Profile to verify their Citation Level and H index.

Identify the Name of Author and Coauthors at most in the Science and Technology Profiles widely accepted by the International Scientific Community ORC ID - Researcher ID Thomson - arXiv Author ID - PubMed Author ID - Open ID respectively.

Indicate the contact for correspondence to the Author (Mail and Telephone) and indicate the Researcher who contributes as the first Author of the Article.

Plagiarism Detection

All Articles will be tested by plagiarism software PLAGSCAN if a plagiarism level is detected Positive will not be sent to arbitration and will be rescinded of the reception of the Article notifying the Authors responsible, claiming that academic plagiarism is criminalized in the Penal Code.

Arbitration Process

All Articles will be evaluated by academic peers by the Double Blind method, the Arbitration Approval is a requirement for the Editorial Board to make a final decision that will be final in all cases. MARVID® is a derivative brand of ECORFAN® specialized in providing the expert evaluators all of them with Doctorate degree and distinction of International Researchers in the respective Councils of Science and Technology the counterpart of CONACYT for the chapters of America-Europe-Asia- Africa and Oceania. The identification of the authorship should only appear on a first removable page, in order to ensure that the Arbitration process is anonymous and covers the following stages: Identification of the Journal with its author occupation rate - Identification of Authors and Coauthors - Detection of plagiarism PLAGSCAN - Review of Formats of Authorization and Originality-Allocation to the Editorial Board- Allocation of the pair of Expert Arbitrators-Notification of Arbitration -Declaration of observations to the Author-Verification of Article Modified for Editing-Publication.

Instructions for Scientific, Technological and Innovation Publication

Knowledge Area

The works must be unpublished and refer to topics of business, administration-administrative, management-SME, management-tourism, hotel, management-financial, administration and other topics related to Social Sciences.

Presentation of the Content

*In number twelve, is presented an article *The strategic management to improve the competitiveness of fuel market companies* by ÁNGELES-GUZMÁN, Casandra, AGUILAR-MORALES, Norma and MAGAÑA-MEDINA, Deneb Elí, with adscription at Universidad Juárez Autónoma de Tabasco, in the next article *Tourism area life cycle analysis in San Miguel de Allende Guanajuato*, by SONDA-DE LA ROSA, Ricardo, RUIZ-LANUZA, Agustin and ALCUDIA-ROCHA, Josefina with adscription at Universidad del Caribe and Universidad de Guanajuato, in the next section *Standardization of the driver certification processes of the company Bebidas Mundial S. de R.L. de C.V.* by ROBLES-ARIAS, Isela Margarita, SO-FELIX, Stephany, ROSAS-ESTRADA, Kenya Patricia and VALDEZ-GUERRERO, Raquel with adscription at Instituto Tecnológico de la Paz, in the next section *Distributed generation with a photovoltaic generating plant interconnected to a medium voltage network in the marginalized town of Xbilincoc, Campeche*, LEZAMA-ZÁRRAGA, Francisco Román, CHAN-GONZALEZ, Jorge de Jesús, SHIH, Meng Yen and SALAZAR-UITZ, Ricardo Rubén with adscription at Universidad Autónoma de Campeche.*

Content

Article	Page
The strategic management to improve the competitiveness of fuel market companies ÁNGELES-GUZMÁN, Casandra, AGUILAR-MORALES, Norma and MAGAÑA-MEDINA, Deneb Elí <i>Universidad Juárez Autónoma de Tabasco</i>	1-6
Tourism area life cycle analysis in San Miguel de Allende Guanajuato SONDA-DE LA ROSA, Ricardo, RUIZ-LANUZA, Agustin and ALCUDIA-ROCHA, Josefina <i>Universidad del Caribe</i> <i>Universidad de Guanajuato</i>	7-21
Standardization of the driver certification processes of the company Bebidas Mundial S. de R.L. de C.V. ROBLES-ARIAS, Isela Margarita, SO-FELIX, Stephany, ROSAS-ESTRADA, Kenya Patricia and VALDEZ-GUERRERO, Raquel <i>Instituto Tecnológico de la Paz</i>	22-33
Distributed generation with a photovoltaic generating plant interconnected to a medium voltage network in the marginalized town of Xbilincoc, Campeche LEZAMA-ZÁRRAGA, Francisco Román, CHAN-GONZALEZ, Jorge de Jesús, SHIH, Meng Yen and SALAZAR-UITZ, Ricardo Rubén <i>Universidad Autónoma de Campeche</i>	34-42

The strategic management to improve the competitiveness of fuel market companies

La gestión estratégica para mejorar la competitividad de las empresas del mercado de combustibles

ÁNGELES-GUZMÁN, Casandra†*, AGUILAR-MORALES, Norma and MAGAÑA-MEDINA, Deneb Elí

Universidad Juárez Autónoma de Tabasco, Academic Division of Administrative Economic Sciences, Mexico.

ID 1st Author: *Casandra, Ángeles-Guzmán* / ORC ID: 0000-0002-2902-6285, CVU CONACYT ID: 914529

ID 1st Co-author: *Norma, Aguilar-Morales* / ORC ID: 0000-0002-7292-3029, CVU CONACYT ID: 478554

ID 2nd Co-author: *Deneb Elí, Magaña-Medina* / ORC ID: 0000-0002-8579-596X, CVU CONACYT ID: 253765

DOI: 10.35429/EJRP.2021.12.7.1.6

Received January 10, 2021; Accepted June 30, 2021

Abstract

Evaluate the effect of Strategic Management on the Competitiveness of fuel marketing companies, to generate a model as a proposal for improvement. Methodology: The methodology to be used is descriptive, since the description of the phenomena of Strategic Management, Competitiveness and Organizational Performance is carried out, through review of scientific research articles by more than 20 authors, in the available databases. In addition, it is of explanatory type since it defines the structure of behavior of the variables, the relationship that exists between them and their components. Contribution: Competitiveness model for fuel marketers.

Strategic administration, Competitiveness, Fuel

Resumen

Evaluar el efecto de Administración estratégica sobre la Competitividad de empresas comercializadoras de combustible, para generar un modelo como propuesta de mejora. Metodología: La metodología a utilizar es de tipo descriptiva, ya que se realiza la descripción de los fenómenos de Administración estratégica, Competitividad y Desempeño organizacional, a través revisión de artículos de investigación científica de más de 20 autores, en las bases de datos disponibles. Además, es de tipo explicativa ya que se define la estructura de conducta de las variables, la relación que existe entre ellas y de sus componentes. Contribución: Modelo de competitividad para empresas comercializadoras de combustible.

Administración estratégica, Competitividad, Combustible

Citation: ÁNGELES-GUZMÁN, Casandra, AGUILAR-MORALES, Norma and MAGAÑA-MEDINA, Deneb Elí. The strategic management to improve the competitiveness of fuel market companies. ECORFAN Journal-Republic of Peru. 2021. 7-12:1-6.

* Author Correspondence (Email: angeles_cachy@hotmail.com)

† Researcher contributing as the first author.

Introduction

Currently, there is a weak competitiveness of local fuel marketers due to the poor application of Strategic Management. Strategic Management enables favorable results for companies in this sector, as it facilitates the implementation of short-, medium- and long-term plans to achieve overall objectives more efficiently and safely. According to Srivannaboon and Milosevic, they mention that the essence of project management is to support the implementation of the organization's strategy as a key process that allows organizations to implement systems that generate value for them. (Srivannaboon, 2006).

To obtain information, a comprehensive review of various authors was carried out to finally generate a competitiveness model as a proposal, which adapts and has the characteristic of universality.

Antecedents

"One of the priorities of the current strategy in the development of countries and regions is the promotion of its competitive capacity, through innovation, entrepreneurial capacity and flexibility of the productive system, in order to gain a competitive advantage over other countries and regions" (Porter, 1991).

For Wright, Kroll and Parnell (2000) the approach to strategic control is both external and internal. None of these elements can be examined in isolation, because the function of senior management is to advantageously align the company's internal operations in its external environment.

According to Costa (2006), he explains that the first stage to be carried out in an internal analysis is to develop a comprehensive, general list of strengths, weaknesses, neutrals and those that need to be improved, that is, those that benefit or harm companies.

Tavares (2005) mentions that all the potentialities and skills of the organization synthesized in its essential and distinctive competencies must also be explored internally, transforming them into forces to seize opportunities and neutralizing weaknesses so that threats do not present thee in the organization.

According to Romo (2008), there are 3 models for measuring competition from a sector that are:

- Product differentiation.
- Barriers to entry.
- Degree of concentration.
- Nature of demand.

Model of porter's 5 forces

Porter (2001), identified 5 basic competitive forces that determine the degree of competition of an industry:

- The threat of entry from new competing companies.
- The negotiating power of suppliers.
- The negotiating power of customers.
- The threat of substitute products or services.
- The rivalry between the different competitors.

Model of the 10 forces of Bueno:

According to Bueno (1995), the structure of the industrial sector is explained by the synergistic conjunction of ten competitive forces: 1. New competitors, 2. International competition, 3. Competition from other sectors, 4. New products, 5. Substitute products, 6. Client trading power, 7. Supplier trading power, 8. State trading power, 9. Shareholder trading power and 10. Negotiating power of social agents.

Model of structure-behavior-results

Jacquemin (1982), assumes a single direction in the cause-and-effect relationship, since from the knowledge of the organizational structure can be inferred the expected competitive results of a sector. Therefore, analyzing the internal factors of organizations is not of greater interest:

Stages to improve an organization

The following describes the steps defined by most authors to improve an organization.

Organizational diagnosis: it is the most important phase of the strategic direction process; and to make a well-made diagnosis requires knowing the field of competence, the evolution of the competitive context, the key success factors that allow to determine the strategic group where the organization will compete. After this, it is necessary to carry out an assessment of the external sector and internal analysis, finally it is necessary to determine the business plan and study its technological positioning. All this with the aim of understanding the reality of the organization and its challenges.

Strategy formulation: it is a key element within the management culture. There are different types of strategies, however, the choice depends on the type of industrial sector, the conditions of the country and the situation that is lived internationally at the time of its application. It is the action that defines the success of an organization, so it must be evaluated continuously, so that the selection of the right strategy entails the success of the management process. Within the same organization, different types of strategies can be applied such as: expansion or growth, stability, associativity, survival and internationalization. The evaluation of strategies: it is an activity of the management team that is usually carried out by intuition or qualitative judgments of experts. Such an assessment should be carried out on the basis of its acceptability, feasibility and adequacy, as it relates to the quality of the strategic plan.

The implementation of strategies: This phase should be planned in detail, especially in terms of the times and the allocation of the resources necessary to carry out. Some of the aspects to be considered at this stage are: interdependence and coordination mechanisms of tasks, power and centralization, types of leadership, culture, staff competencies, information systems, performance assessment systems, and organizational structure. It is essential to consider these aspects for a successful implementation of strategies.

The design of the organization: is a critical aspect of the implementation of strategies. Typically, the problems that arise when making a design that accompanies the strategy are: 1. Size, 2. Horizontal differentiation (specialization and departmentalization), 3. Vertical differentiation, control section and redesign of posts, 4. Position design, 5. Interdependence and Coordination, 6. Centralization-decentralization, 7. Technology, 8. Degree of formalization, 9. Power, 10. Leadership Style, 11. Organizational culture, 12. Information systems, and 13. Reward systems. Organizations are constantly evolving or changing, and that means they have had important events, some planned and other fortuitous events that have strengthened and filled it with experience, therefore, some models at this stage can be very useful such as the LART model (Rivas, 2016), as it is easy to compress and universal. Based on Mintzberg's (1987) models, other organizational models have emerged recently, which seek to be flexible and counteract the problems caused by the highly changing, uncertain and unstable environments that characterize companies today. All these models have as a common characteristic the break of the classic principles of the organization, such as formalization, centralization, standardization, etc. The current needs of the international environment require coordination and cooperation of the new core competences of an organization, in addition to the application of recent technology; this allows to create versatility to respond to new market segments, identifying business opportunities, which gives way to more complex organisms, which are understood through their relationships. Through the union of complementary competencies and synergies in the value chain, completely different organizations may emerge. These organizational models seek to win-win, replacing the principles of hierarchy and authority, with those of knowledge and information.

Strategic control: Control has evolved over time, as it went from being a corrective instrument to an online management tool, which allows not only to measure compliance with what is planned, but also to the implementation and implementation of strategic measures.

Control, like other administrative management techniques, depends on organizational culture, the strategic vision of managers, organizational practices such as exchanging information and knowledge, teamwork and the type of leadership that is exercised. However, it is important to emphasize that control with a classic approach is still widely used in several organizations due to their need to concentrate specific information on the personnel responsible for each area or process in order to measure it. The most effective control can be political, intuitive, trial, trial and error, or routine. The most recent are the Dashboards (Balanced Scorecard), which represent a superior form of control, as they allow to operationalize and measure the strategy, harmonizing through the use of strategic maps four fundamental perspectives: the financial perspective, the perspective of customer satisfaction, the perspective of internal processes and their priorities, and the perspective of culture and organization. An advantage of dashboards is that they allow indicators to be related to the achievement of strategic objectives and the company's vision by objectively assessing how strategies are met. However, its implementation requires prior information such as the existence of a strategy clearly defined and known to all the staff of the organization, and not only that it has been formulated by senior management, since it must be formally written, known and shared. In addition, strategic objectives must be clear.

Methodology

The methodology to be used is quantitative and qualitative in nature, which includes: The Design of research for preliminary study: Structured Survey, and Design for group dynamics, in-depth interviews with the Delphi method.

Design of research for preliminary study:

Structured survey

- Define the target population: persons with light vehicles for private use.
- Define the sampling plan: sample size and selection.
- Design of the measuring instrument and means to be performed, either personally or electronically.

Design for group dynamics, in-depth interviews with the Delphi method

- Selection of sales experts and related areas, through 4 rounds of direct interviews.
- Determination of the time and resources required such: as place to perform, support staff, video camera, recorder, sheets, pencils, computer equipment, cannon, etc.
- Elaboration of the script of the dynamics of the interview and questionnaires.

Results

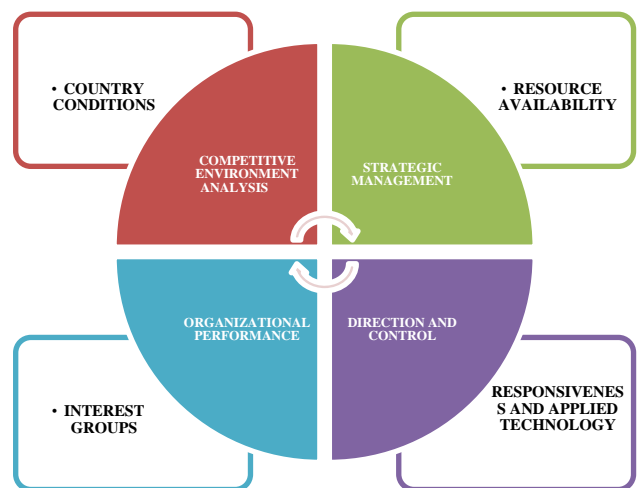


Figure 1 Competitiveness model in industrial sectors

Source: Author's Percept, 2021

After applying the instruments described in the methodology to both the target market of this sector and to a group of experts, it was determined that to become competitive in this sector the following factors must be considered both internally and externally:

Competitive Environment Analysis: The market under which you compete directly must be continuously analyzed. It is worth mentioning that of the 11,776 stations in Mexico, 2400 service stations are from another country so Petróleos Mexicanos (Pemex) has lost 21% market share to the new brands, according to data from the Ministry of Energy (SENER, 2018).

Strategic management: Each strategy must be aligned with the objectives and policies of the company and must be adjusted to the needs of the company, which are part of the strategic planning. In addition, it is necessary to continuously measure the indicators of key processes applying: scientific research, analyzing past facts, and the use of forecasting tools that allow us to have a clear and complete view of the scenario, to glimpse the future of the company by making the necessary adjustments or changes to achieve the desired results.

Organizational performance: Se must save resources to maximize profits, thus avoiding deviations, thefts or losses. To do this, staff are required to have a great sense of belonging to the company, since each is responsible for the whole system functioning properly through a highly efficient performance, for this reason, important that they get involved and know all the processes, especially those that contribute mostly to the achievement of the strategic objectives of the company, that is, the key processes.

Management and control: There must be integration into the company both internally and externally, to know at any time the results and take immediate action in case of unforeseen events. The idea is to close the gaps between what is planned and what is executed at the point of sale based on an integrated system that allows to share information in a simple and real time of the results of the operation.

Country conditions, Availability of resources, stakeholders-set capacity and Technology applies: These factors affect companies in the sector externally, since they cannot control that the Government of the country where it is operating makes the necessary efforts to achieve market competitiveness in an effective manner. Much will depend on the cooperation and support network that exists between companies engaged in similar activities and that in some way exert pressure to make this possible. In addition, resource availability is often limited, because resources are exhaustible and must be used rationally. Finally, responsiveness and applied technology will depend on the availability of specialized labour with the capacities and competencies for value creation, innovation, identification and ease of solving the problems of today's society.

Conclusions

Today companies in this sector must have automated processes, immediate responsiveness to customers, identify in time actions of the competition, motivation and clarity of the sales team to execute greater geographical scope and a diversification of channels. These factors make it possible to identify opportunities for business units or gas service stations.

Businesses oriented towards total customer satisfaction should be developed, as attention to a specific demand is necessary to maintain their competition in the market, i.e. identify the niche market in such a way that all its efforts, materials, resources and skills are directed to the generation of value in its goods and / or services for that market. Therefore, the measurement and improvement of each of its processes must be continuously carried out, which must be flexible, adapting to the constant changes of the current environment.

It is of the utmost importance to carry out an analysis continuously, to be alert to changes in consumer tastes and preferences, as well as to have a comprehensive diagnosis of the company, to innovate and evolve always considering first of all its customers, achieving their loyalty, to stay in a highly competitive market. Likewise, it is necessary to obtain information that contributes to the growth and development of the company based on real data, which when analyzing them allow us to know: the type of gasoline that respondents consume the most for their vehicles, their consumption in liters per week, the gas station of their choice, and aspects that for the decision-making of purchase.

References

- Al Ries y Jack Trout. (2002). *Posicionamiento: La batalla por su mente*. Traducción: Karla Ivonne Sáinz de la Peña Alcocer. Editorial Mc GRAW HILL.
- Alcaraz Rodríguez Rafael Eduardo. (1999). *Guía de planes de negocio* edición Mc GRAW HILL. México.
- Jürgen Klaric (2012). *Estamos ciegos*. Bajo el sello Editorial PAIDÓS M. R.

Lana, Rogelio Adilson La Administración Estratégica como Herramienta de Gestión. *Revista Científica "Visión de Futuro"* [en línea]. 2008, 9(1), [fecha de Consulta 17 de abril de 2021]. ISSN: 1669-7634. Available at: <https://www.redalyc.org/articulo.oa?id=357935469001>

Rivas Tovar Luis Arturo (2016). *Dirección estratégica*. Editorial Trillas, S. A. de C. V.

Romo Vázquez, Hugo, & Rivas Tovar, Luis Arturo. (2012). Modelo de competitividad de las empresas operadoras de telefonía móvil en México. *Contaduría y administración*, 57(1), 123-148. Recovered on April 18, 2021, from: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0186-10422012000100007&lng=es&tlng=es.

Velásquez Peñaloza, D. M., & Monroy Díaz, M. Á. (2021). *Proceso de evaluación de adopción de buenas prácticas en economía circular en los proyectos desarrollados en la empresa DMMA petróleo* (Master's thesis, Maestría en Gerencia de Proyectos).

Tourism area life cycle analysis in San Miguel de Allende Guanajuato

Análisis del ciclo de vida de los destinos turísticos en San Miguel de Allende, Guanajuato

SONDA-DE LA ROSA, Ricardo†*, RUIZ-LANUZA, Agustin and ALCUDIA-ROCHA, Josefina

Universidad del Caribe, Mexico.

Universidad de Guanajuato, Mexico.

ID 1st Author: Ricardo, Sonda-de la Rosa / ORC ID: 0000-0002-6788-4758, Researcher ID Thomson: AAN-4749-2021, arXiv Author ID: rsonda, CVU CONACYT ID: 416187

ID 1st Co-author: Agustin, Ruiz-Lanuza / ORC ID: 0000-0002-9604-8310, CVU CONACYT ID: 222896

ID 2nd Co-author: Josefina, Alcudia-Rocha / ORC ID: 0000-0002-5953-2859

DOI: 10.35429/EJRP.2021.12.7.7.21

Received January 15, 2021; Accepted June 30, 2021

Abstract

The Tourism Area Life Cycle model is in itself one of the most used tools to analyze tourist competitiveness. In order to solve the problem of the lack of a comprehensive tourism strategy in the city of San Miguel de Allende that can comply with sustainable development, this research establishes its objective in the documentary analysis of the evolution of the tourism indicators that it has presented in destination for its analysis and comparison with the model of the Tourism Area Life Cycle model, identifying in the corresponding stage and thereby establishing relevant tourism planning strategies. The document was developed with a descriptive quantitative approach that used documentary review and analysis techniques of various tourist indicators of the destination. In conclusion, it is highlighted that the city of San Miguel de Allende has individual indicators in various stages of the life cycle: Development, Consolidation, and Decline; globally, it has been in the Stagnation stage since 2015 with prominent features of Decline and Rejuvenation. This results in an obvious need to define sustainable tourism management strategies to boost the destination's competitiveness effectively.

Turistic development, Tourist indicators, Life Cycle Indicar

Resumen

El modelo del Ciclo de Vida de los Destinos Turísticos es en sí mismo una de las herramientas más utilizadas para analizar la competitividad turística. Con el fin de resolver el problema de la falta de una estrategia integral turística en la ciudad de San Miguel de Allende que pueda cumplir con un desarrollo sustentable, esta investigación establece su objetivo en el análisis documental de la evolución de los indicadores turísticos para su análisis y comparación con el modelo del Ciclo de Vida de los Destinos Turísticos identificado en la etapa correspondiente y con ello establecer estrategias pertinentes de planificación turística. El documento se desarrolló con un enfoque cuantitativo descriptivo haciendo uso de técnicas de revisión y análisis documental de indicadores turísticos. Como conclusión, se destaca que la ciudad de San Miguel de Allende cuenta con indicadores individuales en diversas etapas del ciclo de vida, los hay en Desarrollo, en Consolidación y en Declive; de manera global, se encuentra en la etapa de Estancamiento desde el año 2015 con rasgos evidentes de Declive y de Rejuvenecimiento. Esto resulta en un aporte para definir las estrategias de gestión turística sustentable para impulsar de manera efectiva la competitividad del destino.

Desarrollo turístico, Indicadores, Ciclo de vida

Citation: SONDA-DE LA ROSA, Ricardo, RUIZ-LANUZA, Agustin and ALCUDIA-ROCHA, Josefina. Tourism area life cycle analysis in San Miguel de Allende Guanajuato. ECORFAN Journal-Republic of Peru. 2021. 7-12:7-21.

* Correspondence to Author (Email: rsonda@ucaribe.edu.mx)

† Researcher contributing first author.

Introduction

One of the references for the analysis of tourism competitiveness is the one proposed by (Butler, 1980) called: Life cycle model of tourist destinations (CVDT) that has supported the determination of the most consistent strategies in current tourism planning. This analysis has been carried out in countries such as: Greece (Michailidou, Vlachokostas, Moussiopoulos, & Maleka, 2016), Malaysia (Shida, Abdul, Badaruddin, & Azizi, 2015), Korea (Lee & Weaver, 2014), Spain (García-Ayllon, 2015) and Chile (García, Reinares, & Armelini, 2013) managing to establish as a result the appropriate tourist positioning or innovation strategies regarding the stage in which the destination was diagnosed, confirming that said model is useful as a basis theory in tourism development today.

According to data from the World Tourism Organization (UNWTO, 2019), at the end of 2018, the number of global travelers was 1,401 billion, which represented an increase of 9.7% compared to the previous year, which meant a spill for the concept of international tourism of 1,451 billion dollars. Mexico as a country received 22.3 million international tourists, of which 21 million were intern (Banco de México, 2021). Tourist mobility in the country's territory was variable but constant, especially in colonial destinations and sun and beach destinations.

The analysis of Mexican tourist destinations under the CVDT model of Butler (1980) is not new, destinations such as Ixtapa - Zihuatanejo (Osorio, Deverdum, Mendoza, & Benitez, 2019), Cozumel (Segrado, 2011) and Puerto Vallarta (Aguilar, 2009), they have done it. Through historical indicators of supply and demand in products and services offered to national and international tourists, they have proposed tourist strategies that are now a reality. However, until now these destinations are oriented to the sun and beach segment, which, although it is one of the most attractive for tourism, the colonial city segment should not be relegated, making it pertinent to carry out an exercise that includes cultural destinations and historical and that for their national and international heritage are demanded by national and international tourism.

The most popular colonial destinations in Mexico are: Zacatecas; Oaxaca de Juárez, Morelia, Mérida, San Francisco de Campeche, Puebla de Zaragoza, Santiago de Querétaro, the city of Guanajuato and of course San Miguel de Allende. San Miguel de Allende is a city of the colonial era recognized for its Spanish Baroque architecture, active artistic scene and cultural festivals, with 171,000 inhabitants, it is part of the Bajío region and has a great wealth of pre-Columbian ancestors, offering an endless number of attractions in the modern cultural and historical environment of the same place.

The basis of this research work is that the city of San Miguel de Allende is a destination considered mature in relation to Butler's CVDT model and that it is in the consolidation stage, however, there is no comprehensive analysis of tourism indicators that can determine it and establish it in the corresponding stage, be it in (development, consolidation, stagnation or even, decline or repositioning).

Analyzing tourist destinations from the perspective of the CVDT model requires a series of exhaustive and in-depth observations, not only analysis of economic indicators, since these are usually the only indicators that are used as input to establish government management policies, but on the contrary, consider other indicators to make a comprehensive analysis that allows to make comprehensive proposals for sustainable, environmental and social development and thereby determine the most precise location of the life stage of the destination in this proven theoretical model.

The main problem is based on the lack of an inclusive tourism strategy in San Miguel de Allende, which can be systematized and structured based on the assessment of the current situation and the assessment of the future situation. For this reason, it is proposed to start with a qualitative and descriptive analysis of its current situation, which will help to build an ideal future and visualize sustainable tourism development from this process.

The idea is that with this study it is possible to avoid over-impacting the levels of load capacity, problems in the quality of the service offered, so as to guarantee the satisfaction of tourists and visitors that is presented in a traditional way when a tourist destination is handled in an ordinary way.

Interpreting the indicators under the Butler model guarantees that tourism strategies are aligned, preventing their decline and, above all, implementing sustainable innovation in a way that generates a positive impact and achieves self-sufficient tourism.

In this way, the objective of this article is to analyze the evolution of tourist indicators that have influenced the present condition of the city of San Miguel de Allende, comparing it with the CVDT model for the correct location in the evolution stage to generate specific strategies of positioning, consolidation or rescue of the cultural destination.

Through the use of qualitative and descriptive methods, the relevant texts of the tourism supply and demand indicators of San Miguel de Allende from scientific articles, development plans and databases were reviewed and analyzed.

The article is divided into four parts: the first part analyzes the CVDT model, the characteristics and the criticisms; the second part describes the research methodology; the third part contains the conclusions drawn from the analysis of the information collected; and the fourth, the indicators that place San Miguel de Allende in its evolutionary stage and the author's final reflections.

Comprehensive life cycle analysis of tourist destinations

The life cycle of a destination is one of the most relevant topics in the analysis of tourism competitiveness, because it shows the evolution of the destination and, despite its limitations, it can help define a comprehensive development strategy. The CVDT model originated from the studies of Richard Butler (1980), who was guided by the conceptual elements of Christaller (1963) and the theory of Vernon and Wells (1966), in relation to the life cycle of a commercial product. Butler integrated a model based on tourism as the main element of the system and the relationship with the locals of the destinations. Combining the definitions of Plog (1973), Doxey (1975) and Cohen (1979), he developed a model that can understand the different stages of any tourist destination over time, establishing it as a management and planning tool. The CVDT model consists of seven stages, which are described below, see Table 1:

ISSN-On line: 2414-4819

ECORFAN® All rights reserved.

Situation	Stage
The tourist destination has just been discovered, and few travelers with an exploration profile visit it. It is mainly visited by nearby towns that seek their attractions that are of natural or cultural origin. Accessibility is limited, as is the supply of infrastructure and tourism and support services.	Exploration
The number of tourists increases as their origin becomes regional. Group trips are organized. Local residents participate in an artisanal way in the provision of tourist services and products. There is a defined timeframe and the government starts financing to improve the destination's infrastructure	Involvement
The growth of tourists grows significantly, mass trips are present, the tourist offer grows in quality and quantity. The external investment to the locality begins, as well as the promotion of the destination nationwide. An image of the destination is created where together the government and private initiative invest in it.	Developing
Tourists have different profiles, the local economy comes mainly from a tourist order organized by political entities. Environmental and social problems are beginning to be perceived. The number of visitors no longer grows so markedly. Actions to maintain visitor indicators are aimed at promoting offers and packages. Foreign investments are consolidated. There is a polarization of residents supporting or not the growth of tourist activity.	Consolidation
Visitors reach their highest level and the increase stops, most are repetitive, the hotel occupancy percentages decrease, the sale or rental of condominiums and residences begins, the load capacity is threatened, economic problems arise, environmental and social conditions of the destination and is the turning point towards the Decline or Rejuvenation stage.	Stagnation
In this stage, the tourist offer is deteriorated, the average stay of tourists falls, strategies to maintain occupation by lowering prices become common, it begins with the flight of foreign capital, the tourist infrastructure shows signs of destruction that must be repaired or replaced or in some cases they change the tour to a non-touristic one.	Slope
Due to the repositioning, a redesign of the destination's tourist offer is presented, a revitalization is achieved with a new national or foreign investment for a more rational use of resources.	Rejuvenation

Table 1. Stages of CVDT

Source: Adapted from (Butler, 2004), (Osorio, Deverdum, Mendoza, & Benitez, 2019), (Diez, 2019)

The first application of the CVDT model in a case study was that of Hovinen (1982) in Lancaster County, Pennsylvania, opening the possibility that other destinations were diagnosed under the same model. Authors such as Choy (1992), Hamzah (1995), and Douglas (1997) have applied this theoretical model as a fundamental tool in the diagnosis and establishment of strategies in decision-making.

As time went by, several theorists naturally emphasized the limitations of Butler's model, making criticisms mainly in relation to: lack of operability, lack of measurement of load capacity, inconsistencies in the definition of one stage and another, the lack of standardized indicators by stage, the lack of considerations of order of sustainability and competitiveness of the destination, as well as the devaluation in the participation of the private initiative and lack of definition of territorial spatial characteristics, (Priestley & Lluís, 1998), (Diedrich & García-Buades, 2009), (Aguiló, Alegre, & Sard, 2005), (López, 2011), (Deery, Jago, & Fredline, 2012), (Vera, Palomeque, Marchena, & Antón, 2013), (Haywood, 1986).

The previous opinions encouraged Butler in 1991 to re-evaluate the proposed model by integrating future variables including: sustainability, dynamics of tourism development, process and management, as well as the measurement of the carrying capacity and spaces of the evaluated destination. Butler (2011) reconsidered the model again emphasizing external factors (attitude, technology, politics and economics) and internal factors (habits, tastes and preferences). These adjustments to the model have served so that other theorists, through their evaluations, enrich the model and have a greater approximation in the sum of tourism indicators that exceed the observed limitations and become a model that can be improved on a day-to-day basis. (Garay & Cánoves, 2011), (Soares, Gandara, & Ivars, 2012), (Yang, Ryan, & Zhang, 2013), (Kristjánssdóttir, 2016).

As a result of the literature review, it can be observed that there is a high degree of similarity between Butler's model and the theorists who postulate it. In this sense, the model must be considered as a method of approximation in the explanation of a reality, without forgetting the peculiarities of each destination that is in principle unique and authentic.

Today, after observation and criticism, Butler's CVDT model is still valid because it still lacks theoretical elements beyond the 1980 assumption (Diez, 2019), so its convenience to analyze tourist destinations in a present situation is used in defining strategies when considering their current stage and projecting their future on the horizon.

Methodology

In order to analyze the evolution of tourist indicators that influence the current situation of the city of San Miguel de Allende and contrasting them with the CVDT model to identify the stage of evolution in which it is located, the basis is the methodological proposal of Jiménez and Jiménez (2015). This research is quantitative and descriptive in scope with a positive level of confidence that makes use of documentary review and analysis of texts and tourist indicators of an economic, social, cultural and urban order to identify the classification factors of the stages with respect to the model of the CVDT.

To search for the information, various primary and secondary sources of official sites were consulted: World Tourism Organization (UNWTO), National System of Statistical Information of the Tourism Sector (DataTur), Federal Secretary of Tourism (SECTUR), Secretary of Tourism of Guanajuato (SEDETUR Guanajuato), as well as web pages, databases, specialized magazines in the area of tourism related to the supply and demand of tourist activities in the city of San Miguel de Allende.

For the bibliographic review, tourist barometers, statistics from the National Institute of Statistics and Geography (INEGI) were consulted, as well as investigations in scientific magazines, official documents of the San Miguel de Allende City Council, critical notes and reports of the tourist activity of the Observatory Tourist of the state of Guanajuato.

After obtaining data, tables and graphs were prepared to show the behavior of the selected indicators and compare them with the situation of each stage of the CVDT model. The conscious and critical analysis resulted in the identification of the stage of evolution that the city of San Miguel de Allende is experiencing, provoking a deep reflection and discussion of the impacts that this has generated.

Results

The free and sovereign State of Guanajuato, see Figure 1, located in the north-central part of the Mexican Republic, with an area of 30,607 km² represents 1.6% of the national territory. In 2015, its population amounted to 5.8 million inhabitants, placing it as the sixth most populated entity in Mexico. It was founded on December 20, 1823.

San Miguel de Allende head of the municipality with the same name is one of the main destinations in the state. Declared a Magical Town in (2002) and in (2017) named by Travel + Leisure magazine as the best city in the world for its level of service, attention, gastronomic services, cleanliness, shopping and mobility that together with its architectural beauty and culture make this place an attractive and safe destination.

In 2008, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations agency in charge of culture and education, declared the city of San Miguel de Allende under the title of Protective Villa of San Miguel and Sanctuary of Jesús Nazareno de Atotonilco, the distinction was awarded for its cultural and architectural contribution to the Mexican Baroque and its importance in the struggle for Mexican Independence from Spain.

In an atmosphere of provincial life with luxury and comfort, the city of San Miguel de Allende is an invitation to enter a cultural city with neo-Gothic towers from the seventeenth and eighteenth centuries, which were carved with pink quarry between cobbled streets in which there are large houses. Colonial buildings, some of them transformed into art galleries or museums, make it a picturesque and cosmopolitan city. Today, the city of San Miguel de Allende is one of the 46 municipalities that the State has; adding to the latter an area of almost 1,500 km² and 171,857 inhabitants.

The proposed indicator analysis considers the following factors: Population analysis, Tourist influx, Connectivity, Hotel infrastructure, Occupancy indicators, Average stay, Complementary businesses, and economic spillover. In each figure the status is highlighted according to the stage of the CVDT model.

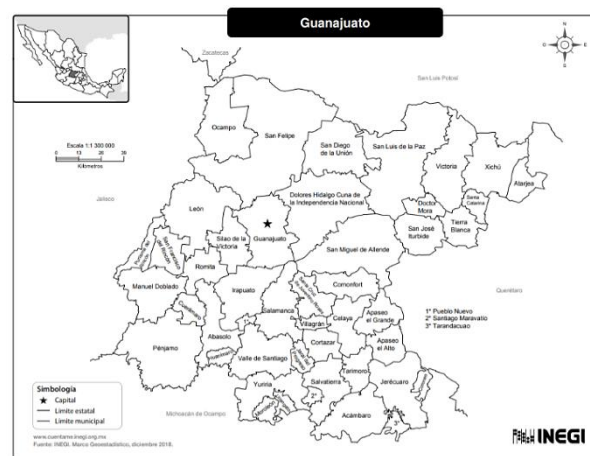
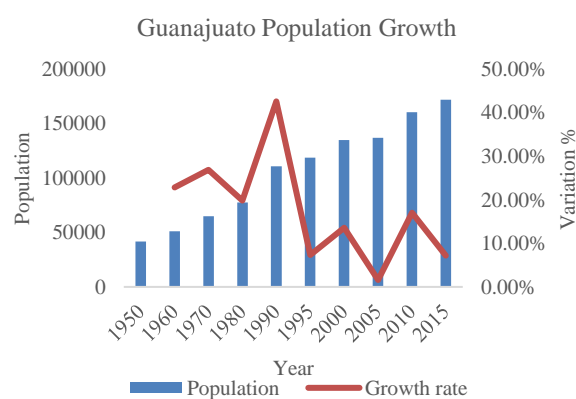


Figure 1 Guanajuato State and its municipalities

Source: (National Institute of Statistics and Geography [INEGI])

Population analysis

The municipality of San Miguel de Allende, which houses the cultural city that bears his name, is located in the center of the State, has had a constant growth, having significant increases in 1990, 2000 and 2010 according to the Population and Housing Census carried out by the INEGI from 1950 to 1990 for decades and then five years, see Graphic 1.



Graphic 1 Guanajuato population growth

Source: (National Institute of Statistics and Geography [INEGI], 1952) (National Institute of Statistics and Geography [INEGI], 1963) (National Institute of Statistics and Geography [INEGI], 1971) (National Institute of Statistics and Geography [INEGI], 1988) (National Institute of Statistics and Geography [INEGI], 1990) (National Institute of Statistics and Geography [INEGI], 1995) (National Institute of Statistics and Geography [INEGI], 2000) (National Institute of Statistics and Geography [INEGI], 2005) (National Institute of Statistics and Geography [INEGI], 2010) (National Institute of Statistics and Geography [INEGI], 2015)

In the fifties, the city of San Miguel de Allende had 41,571 inhabitants, which increased by 23% by the sixties. By the 1970s, the population grew to 51,069, 27%.

For the decade of the seventies and eighties the growth was constant in growth with 64,794 and 77,624 inhabitants respectively. In the 1990s, there was a significant increase, reaching 110,692, a phenomenon that was replicated in 2000 with 134,880 and in 2010 with a population of 160,383. The growth rate of the last 65 years is 1,313%.

The economic growth of the city of San Miguel de Allende has brought benefits related to tourism to the inhabitants, however, for the original San Miguelenses they begin to question the accelerated transformation of spaces that were homes to tourist products, forcing an expansion accelerated population from the surrounding population, generating discontent among residents. Likewise, the social problems typical of a city that has grown in this way are present, as stated by Butler in the stagnation stage, where saturation is expressed in environmental terms (traffic problems, lack of land, water supply, quality of air or lack or failures of electrical energy), elements that for the city center is already common.

Although in the Figure it can express a constant growth numerically, in the geographical contexts of San Miguel de Allende, according to the CVDT model, its population growth behavior places it in the stagnation stage, since it already presents excessive carrying capacity in the city center, environmental wear and tear and social problems, which do not help tourist activity at all, main discontent among the original locals.

Tourist influx

The analysis of the arrival of tourists and the connectivity to a tourist destination go hand in hand, because if the second is developed, the first occurs as a consequence. In this last aspect, the city of San Miguel de Allende has registered a positive trend, since 1996, the year in which it registered 200,857 tourist arrivals (national and foreign), during the following years and until 2009 the average growth registered 25.2%, year in which there is evidence of higher growth in its history from 2010 to 2017 with 177%, which has decreased in 2018 and 2019, (DataTur, 2020), see Graphic 2.



Graphic 2 Tourism growth in San Miguel de Allende
Source: Adapted from (DataTur, 2020)

To commemorate the bicentennial of the country's independence, in 2010 strategies such as the "Guanajuato Centennial Passport 2010" were formulated, which resulted in an increase in visitors to the destination, where the change from tourists from excursions to tourists in organized groups was evident, laying the foundations of a rejuvenation initiating a recovery maintained until 2017, mainly due to the diversification of its products due largely to municipal and state policies of rational use of resources, as well as changes in tastes, and expectations of tourist consumption by the demanding levels of quality in services, respect for the environment and the products they consume (García, Mielgo, & Saco, 2010).

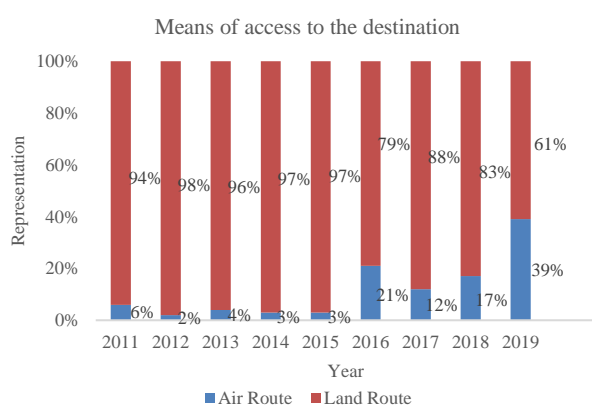
In the development of the tourist influx of the destination, an interesting fact is the main participation of national tourism, which in 2017 reached its highest point with more than 444 thousand people. On the other hand, international tourism, which in 1995 came to represent just over 10% of total tourists, the largest in its history so far, has remained on average the last decade (2009 to 2019) at 9%.

According to the CVDT model, the evolution of visitors to San Miguel de Allende places it in the Stagnation stage.

Connectivity

It is necessary to complement the previous indicator with others, such as the means of access for tourists. Improved air and land connectivity in recent years has meant an opening to new tourist flows to the State.

This clearly shows that tourists are transported mainly by land, either by private car or by bus, along the highways that connect municipalities, including other States, as Puig (2021) comments, regarding the empirical evidence regarding the contribution of tourism to development in emerging destinations, analyzing the socio-economic benefits reported by tourism specialization, see Graphic 3. It is also notable that the growth of arrival at the destination by air since 2016, has added new tourism markets that joins the traditional.



Graphic 3 Means of access to the destination

Source: Adapted with data from the Tourism Observatory of the State of Guanajuato (2011); (2012); (2013); (2014); (2015); (2016); (2017); (2018); (2019)

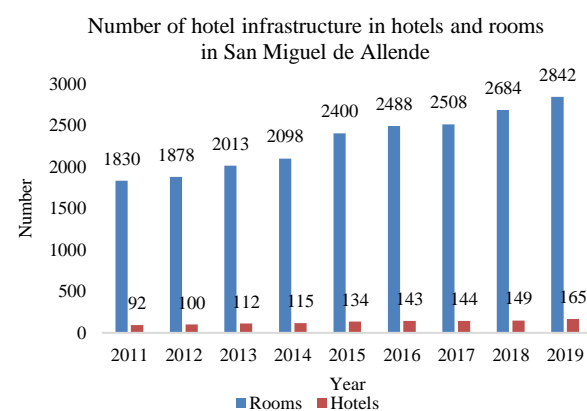
The Bajío International Airport (IATA Code: BJX), operated by Grupo Aeroportuario del Pacífico, also known as Guanajuato International Airport, is located very close to the city of Silao, with a capacity to serve 26 flights per hour. This is considered one of the busiest in Mexico; Its privileged location, 90 minutes from the city of San Miguel de Allende, provides safe and high-quality transportation, making tourists who travel by air from national or international destinations consider this mode of access to the tourist destination.

After 2013, with the remodeling of the airport and the entry of low-cost flight companies to and from Bajío, the arrival by air to the city has been increasing, rebounding especially in 2016 where it increased 18 percentage points and in 2019 reaching its historical maximum 38% of tourists who visit the destination. This has marked a new stage of tourism by air, which makes use of car rentals, minivans or local transport routes.

As a result of the analysis of these indicators and their evolution, the stage in which it is situated with respect to the CVDT is that of rejuvenation, due to the increase in air accessibility caused by various factors (travel policies, promotions, prices, supply and demand) and with This is a real opportunity to visit the destination and make use of the tourist infrastructure described below.

Hotel infrastructure

The analysis of the hotel and room supply of the city of San Miguel de Allende itself provides a key indicator that can place it in any of the stages of the CVDT. From 2011 to 2017, the number of hotel establishments has been increasing, a year in which there was a small setback, but quickly recovered in the following year, reaching its historical maximum with 165 in 2019. In this sense, it can be considered that it is in the consolidation stage. It is important to consider that despite the fact that in recent years they have been presented as an extra hotel offer: collaborative accommodation, or renting houses, or apartments by season, or those who stay with family or friends, it has not affected this indicator.



Graphic 4 Number of hotel infrastructure in hotels and rooms in San Miguel de Allende

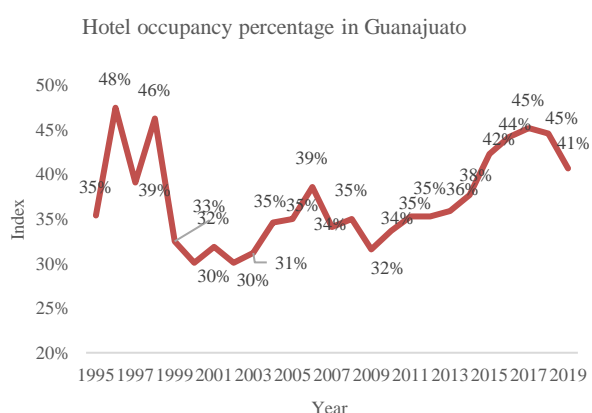
Source: Adapted with data from the Tourism Observatory of the State of Guanajuato (2011); (2012); (2013); (2014); (2015); (2016); (2017); (2018); (2019)

However, if the number of rooms in these establishments is not included, the analysis of this variable cannot be considered complete, since as a whole since 2011 it has maintained a constant growth, the most favorable years being 2015 and 2019 according to the figures registered by the Observatory (2,842 rooms), see Graphic 4.

The behavior of the number of rooms shows that when related to the CVDT model San Miguel de Allende has passed from the Development stage to the Consolidation stage, however, when considering the reduced territorial space in which the development is presented, it shows evident social characteristics of stagnation and even decline.

Hotel occupancy

Regarding the number of hotels and the availability of rooms, it is necessary to specify the occupancy rate of the accommodation-oriented infrastructure, which will be illustrated in Figure 6 below.



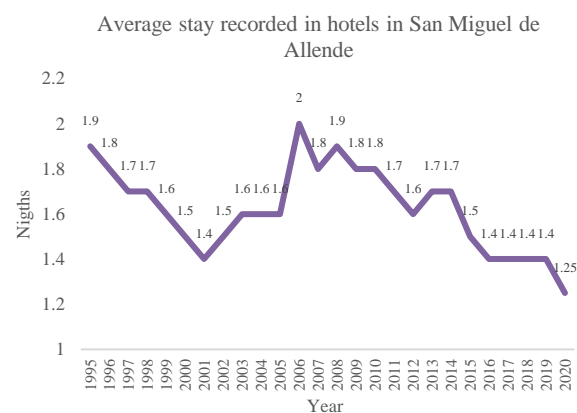
Graphic 5 Hotel occupancy percentage in Guanajuato
Source: Adapted from (DataTur, 2020)

From 1995 to 2002, the hotel occupancy rate in San Miguel de Allende underwent erratic changes, and stabilized upwards reaching 39% occupancy in 2006, decreasing 7 percentage points in the next 3 years when it marked a recovery that until 2018 it was positive, decreasing 3 percentage points in 2019.

With the previous data regarding the percentage of hotel occupancy in the destination, it is confirmed that it is in a stagnation stage according to the CVDT model and that, although the number of rooms is increasing, this is not the case in the occupancy percentages.

Average stay

The analysis of the occupancy percentage is complementary to that of the average stay of tourists who stay in the hotel infrastructure, as shown in Graphic 6.



Graphic 6 Average stay recorded in hotels in San Miguel de Allende

Source: Adapted with data from the Tourism Observatory of the State of Guanajuato (2010); (2011); (2012); (2013); (2014); (2015); (2016); (2017); (2018); (2019) and (DataTur, 2020)

In all records since 1995, the average stay in the city of San Miguel de Allende is less than two nights with a marked trend of decrease from 1995 to 2001 and from 2006 to date. This indicator can be explained from different angles, although the stay in San Miguel de Allende is reduced, the connectivity between the two cities of Guanajuato can promote a tourist flow that is beneficial for the economic overflow of the state. It is important to note that the temporality or seasonality of the destination is significant and highly subject to holiday periods, as well as those on weekends where the stay is extended due to various scheduled socio-cultural events.

This semi-stable phenomenon of hotel accommodation refers to the Stagnation stage with respect to the Butler model, when tourists reach their highest level of stay and most of them become repetitive tourists who, as noted above, even start with the search for renting apartments or houses instead of established hotels, confirming Vena's position (2021) regarding that a tourist consumes a destination following the theory of nodes, visiting first what causes the visit and secondarily the expenses around them.

Tourist establishments

Although the hotel industry and the catering industry are considered the most representative, the other complementary elements of tourism activities described in Table 1 below should also be analyzed.

Year	Unstable foundations total	Hotels	A&B	Aux. Tur	Transport	Lease.
2020	ND	ND	ND	ND	ND	ND
2019	823	165	233	1	34	2
2018	174	149	ND	ND	ND	ND
2017	420	144	95	1	27	2
2016	462	143	51	10	14	2
2015	393	134	82	1	15	2
2014	369	115	95	1	27	2
2013	367	112	95	1	27	2
2012	328	100	75	3	27	2
2011	269	92	92	ND	34	2

Year	Agencies	SPA	Turistic guides	Enclosures	Attractive
2020	ND	ND	ND	ND	ND
2019	19	40	69	44	216
2018	ND	ND	25	ND	ND
2017	15	17	ND	16	103
2016	12	29	14	17	170
2015	15	20	10	18	96
2014	15	17	9	16	72
2013	15	17	9	16	73
2012	15	17	ND	16	73
2011	14	ND	22	6	7

Table 1 Number of tourist establishments in San Miguel de Allende

Source: Adapted with data from the Tourism Observatory of the State of Guanajuato (2011); (2012); (2013); (2014); (2015); (2016); (2017); (2018); (2019)

According to the statistics of the Tourism Observatory of the State of Guanajuato, the total number of tourist establishments in general has been constantly increasing. Figure 8 describes by categories the establishments in: Hotels, A and B (restaurants, cafeterias), Tourist Assistance Services (information modules, cranes, mechanics, automotive services, vulcanizers), Transporters, Car rental companies, Travel agencies, Spas, Tourist guide services, Venues (auditoriums, lounges) and Attractions (stadiums, museums, galleries, shops, markets).

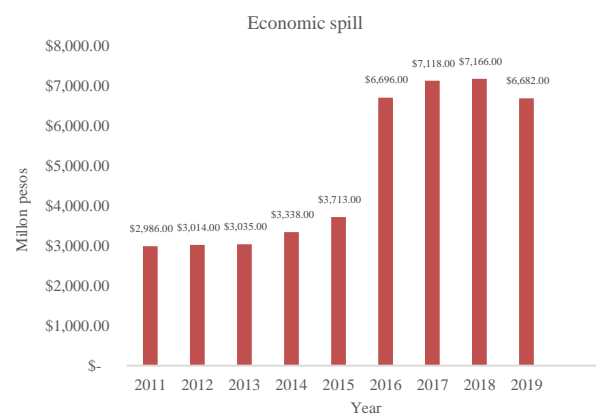
A characteristic of the CVDT stage in decline is the price reduction strategy to maintain the operation of tourism products and services amid the varied competition in the market. San Miguel de Allende shows characteristics of great supply and less and less demand, so the Decline stage in this sense is evident.

Economic spill

Creating jobs and thus sources of income for the community does not necessarily demonstrate sustainable and positive growth, since the over-saturation of services and products can become a problem of supply and demand, since what is sought is to maintain a fair balance.

In the case of San Miguel de Allende there is an imbalance, given that there is a parallel offer of unregistered products and services that are operating in the city, informal commerce, family establishments that do not reach the category of businesses or simply the independent premises that offer services without being registered or regulated by the municipality.

These formal businesses, and the informal ones in the same way, make tourists have an explained economic benefit, which is outlined in Graphic 7.



Graphic 7 Economic spill of Guanajuato
Source: Adapted with data from the Tourism Observatory of the State of Guanajuato (2011); (2012); (2013); (2014); (2015); (2016); (2017); (2018); (2019)

Regarding the economic spill in the city of San Miguel de Allende, this is as variable as it is interesting: in 2011 it was the year with the lowest spill, with only 2,986 million pesos; However, for the following year and thereafter there has been continuous growth, which for 2016 was very significant, increasing almost 100%, reaching 7,166 million pesos in 2018, a historical figure for the city and a boom in commercial activities that was overshadowed by the end of 2019, when it fell to about 6,682 million pesos.

In the last 5 years, the economic spill of San Miguel de Allende has remained in the range of 6,000 to 7,000 million pesos and that in 2020 an average spill is estimated, therefore, in this sense, the CVDT model is situated in Consolidation stage.

Comprehensive analysis

By analyzing the information, it is possible to locate some indicators of the city of San Miguel de Allende in certain stages and place some indicators in other stages. However, globally the destination was in the Consolidation stage, after the commemorative activities developed in 2010 around the bicentennial of Independence and the centenary of Revolution. After five years, in 2015 it entered a stage of Stagnation, with appreciations towards Decline in aspects related to traditional tourist infrastructure, and of Rejuvenation in aspects such as a diversified offer with complementary services and its own evolution of extra-hotel accommodation.

Although the area of the historic center retains its charm, it has ceased to be a residential area to become a commercial area, and with it the loss of landscapes of a traditional town is being transformed into a commercial one, deteriorating the image of the destination. However, diversified services around cultural tourism are on the rise, hosts of festivals of international stature mean that the city of San Miguel de Allende does not lose the magic that has characterized it since its origins.

In the documentary analysis on the evolution of tourist indicators that influence the present condition of the city of San Miguel de Allende, comparing it with the CVDT model and its corresponding stages, it would be risky to determine a single stage with respect to the CVDT model since it does not. There are sufficient studies to determine the carrying capacity, ecological standards and consumption of official and unofficial products and services, so that the economic, cultural, territorial and social elements can have individual stages of development, consolidation, stagnation, decline or rejuvenation. Inviting individualized implementation for each of the variables in a great inclusive strategy to improve the destination.

Conclusions

This work uses the CVDT model as a starting point in the city of San Miguel de Allende depending on the stages it is in to address the problem of lack of a comprehensive tourism strategy that promotes sustainable tourism development.

From the results of the evaluation of the city of San Miguel de Allende, it is concluded in a global way that the Exploration and Involvement stage (before 1990) has been passed, as well as the Development stage (1990 to 2009) and the of Consolidation (2010 to 2014), currently in the Stagnation stage (since 2015), with specific features of Decline (decrease in average stay, concentration of temporality, change in the profile of visitors and tourists, deterioration of the traditional tourist plant, and damage to the environment) and Rejuvenation at the same time (diversification of products related to culture and heritage).

The security crisis throughout Mexico and in particular in the state of Guanajuato is a permanent factor in consideration for tourists and visitors, the warnings of the United States to its citizens about trips to Mexico do not favor the flow of tourists to the city, for what the prevention and visitor care measures adopted by the State, through its promotional programs, have a direct impact on visitor perception, with the objective of minimally having a negative impact on tourism indicators.

The connectivity that the State and the city of San Miguel de Allende presents has attracted tourists of all socioeconomic levels who have found a variety of options from hostels to grand tourism hotels or high-level residential tourism, where the massive influx of tourists has contributed to the growth of the local economy. In recent years, San Miguel de Allende, as a cultural destination par excellence, has entered the romance and wedding segments, as well as incentive trips, and congresses and conventions. Destinations such as San Miguel de Allende must consider that the financial and economic crisis in the world and in Mexico should be the engine of evolution to establish strategies that serve specific segments where Guanajuato is a leader, increasing personalized services that will be reflected in the satisfaction of tourists and locals.

San Miguel de Allende is considered one of the national leaders in cultural tourism, so it has to create a higher status by promoting authentic attributes of its city, architecture and landscapes, making planned strategies to diversify products with the same premise without altering its heritage product that allow to market and promote said offer involving all the agents involved in the tourism model.

With this summary of indicators that feed the analysis of the CVDT model for the city of San Miguel de Allende, local governments can make use of the information to redirect actions towards the regeneration of a destination that integrates the private (commercial) sector and the resident community. Participate directly or indirectly in the consolidation and innovation of the tourist offer, assuming benefits and responsibilities in sustainable, fair and equitable exercises in the long term, since according to (Domareski, 2015), the organization of a territory must be seen and analyzed through the integration of the perspective between the different social dimensions.

Sustainable development must be considered as a strategic project of a tourist destination, combining the collective actions of communities, government entities and private initiatives to create cultural meaning with real expressions that can be truly commercialized and generate economic benefits for the entire destination.

A proposal that arises to follow up on this analysis is related to the application of a Balanced Scorecard for decision making that allows the development of sustainability strategies for a destination as described by Carvajal (2021) through a detailed discussion that can provide a clear vision of practical requests in the objects of study.

The results of this research will be useful once the city of San Miguel de Allende establishes its horizon in the immediate evolution, aware of its problems and areas of opportunity, the management and tourism development of the destination will impact the state and national tourism indicators by This establishes a basis for future research for other tourist destinations due to the replicability of the tool and diagnosis carried out taking into account the needs of tourist rethinking in this new normality. The final comment addresses the challenges facing the tourism sector today, those destinations that triumph will be those that provide reliable and personalized services to tourists who today are more demanding and have greater access to information, globalized tourists. that transcend borders and that seek not only products or services, but also maintain close contact with the places they visit, where products and services can make them experience, excite and become the protagonists of their travels.

References

- Aguilar, C. (2009). El ciclo de vida de un destino turístico: Puerto Vallarta, Jalisco, México. *CULTUR: Revista de Cultura y Turismo*(1), 1-24.
- Aguiló, E., Alegre, J., & Sard, M. (2005). The persistence of the sun and sand tourism model. *26*(2), 219-231. doi:10.1016/j.tourman.2003.11.004
- Banco de México. (2021). *Banxico*. Obtenido de Saldo e Ingreso: <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?accion=consultarCuadroAnalitico&idCuadro=CA198§or=1&locale=es>
- Butler, R. (1980). *The concept of tourism area cycle of evolution: Implications for management of resources*. (2006 ed., Vol. 1). Clivendon USA: Channel view Publications.
- Butler, R. (2004). The Tourism area life cycle in the twenty-first century. *A companion to tourism*, 159 - 170. Obtained from: <https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470752272.ch13>
- Butler, R. (2011). Tourism area life cycle. *Contemporary Tourism Reviews*, 1-33.
- Carvajal, G.; Chávez, A.; Rivera, D. & Almeida, E. (2021). Cuadro de Mando Integral para la toma de decisiones y desarrollo de estrategias de sustentabilidad de un destino turístico. *Journal of Business and Entrepreneurial Studie*, *5*(1), 113–134. <https://doi.org/10.37956/jbes.v5i1.164>
- Choy, D. (1992). Life cycle models for Pacific island destinations. *Journal of Travel Research*, *30*(3), 26-31.
- Cohen, E. (1979). A Phenomenology of Tourist Experiences. *Sociology*, *13*(2), 179-201. doi:10.1177/003803857901300203
- CONACULTA. (2002). *Guías del patrimonio cultural y turismo*. Obtained from: https://patrimonioculturalyturismo.cultura.gob.mx/guias/guia7_5.php
- SONDA-DE LA ROSA, Ricardo, RUIZ-LANUZA, Agustin and ALCUDIA-ROCHA, Josefina. Tourism area life cycle analysis in San Miguel de Allende Guanajuato. ECORFAN Journal-Republic of Peru. 2021

- Cristaller, W. (1963). Some Considerations of Tourism Location in Europe: The peripheral Regions - Underdeveloped countries - Recreation Areas. *Regional Science Association papers*(12), 95-105.
- DataTur. (2020). *Actividad Hotelera en Centros Turísticos Seleccionados por Categoría*. Obtained from: www.datatur.sectur.gob.mx/SitePages/ActividadHotelera.aspx
- Deery, M., Jago, L., & Fredline, L. (2012). Rethinking social impacts of tourism research: A new research agenda. *Tourism Management*, 33(1), 64-73. doi:10.1016/j.tourman.2011.01.026
- Diedrich, A., & García-Buades, E. (2009). Local perceptions of tourism as indicators of destinations decline. *Tourism Management*, 30(4), 1-10.
- Diez, V. (2019). El modelo de ciclo de vida de los destinos turísticos vigencia, críticas y adaptaciones al modelo Butler. *17*, 19-34.
- Domareski, T. (2015). A dinâmica evolutiva da competitividade do destino turístico Curitiba. Tese apresentada como requisito a obtencao do grau do Doutor em Geografia. Universidad Federal do Paraná.
- Douglas, N. (1997). Applying the life cycle model to Melanesia. *Annals of Tourism Research*, 34(1), 1-22.
- Doxey, G. (1975). A causation theory of visitor-resident irritants: Methodology and research inferences. *Sixth annual conference proceedings of the Travel Research Association*. San Diego, USA.
- Expansión. (2017). *expansion.mx*. Obtenido de <https://expansion.mx/tendencias/2017/07/12/san-miguel-de-allende-es-nombrada-la-mejor-ciudad-del-mundo>
- Garay, L., & Cánoves, V. (2011). Life cycles, stages and tourism history. The Catalonia (Spain) experience. *Annals of Tourism Research*, 38(2), 651-671. doi:10.1016/j.annals.2010.12.006
- García, B., Reinares, E., & Armelini, G. (enero-junio de 2013). Ciclo de vida de los destinos turísticos y estrategias de comunicación: los casos de España y Chile. *aDRResearch*, 7(7), 76-93. doi:10.7263/ADR.004.01.5
- García, H., Mielgo, A., & Saco, M. (2010). El desafío del sector turístico español: reposicionamiento de la oferta y retos promocionales para la adaptación a los nuevos segmentos. *Actas del 11º Forum Internacional sobre Las Ciencias, las Técnicas y el Arte aplicadas al Marketing* (págs. 121-142). Academia y Profesión.
- García-Ayllon, S. (2015). Geographic Information System (GIS). Analysis of impacts in the tourism area life cycle (TALC) of a Mediterranean Resort. *International Journal of Tourism Research*, 18, 186-196. doi:10.1002/jtr.2046
- Guanajuato, O. T. (2010). *Perfil del Visitante a la Ciudad de Guanajuato 2010*. Obtained from: <http://www.observatorioturistico.org/publicaciones>
- Guanajuato, O. T. (2011). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2011*. Obtained from: <http://www.observatorioturistico.org/publicaciones>
- Guanajuato, O. T. (2012). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2012*. Obtained from: <http://www.observatorioturistico.org/publicaciones>
- Guanajuato, O. T. (2013). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2013*. Obtained from: <http://www.observatorioturistico.org/publicaciones>
- Guanajuato, O. T. (2014). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2014*. Obtained from: <http://www.observatorioturistico.org/publicaciones>
- Guanajuato, O. T. (2015). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2015*. Obtained from: <http://www.observatorioturistico.org/publicaciones>

Guanajuato, O. T. (2016). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2016*. Obtained from: <http://www.observatorioturistico.org/publicaciones>

Guanajuato, O. T. (2017). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2017*. Obtained from: <http://www.observatorioturistico.org/publicaciones>

Guanajuato, O. T. (2018). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2018*. Obtained from: <http://www.observatorioturistico.org/publicaciones>

Guanajuato, O. T. (2019). *Perfil del Visitante a la Ciudad de San Miguel de Allende 2019*. Obtained from: <http://www.observatorioturistico.org/publicaciones>

Hamzah, A. (1995). The changing tourist motivation and its implications on the sustainability of small-scale tourism development in Malaysia. *World Conference on Sustainability Tourism*. Lanzarote, Spain.

Haywood, M. (1986). Can the tourist-area life cycle be made operational? *Tourism Management*, 7(3), 154-167.

Hovinen, G. (1982). Visitor cycles: Outlook for tourism in Lancaster Country. *Annals of Tourism Research*, 9(4), 565-583.

Instituto Nacional de Estadística y Geografía [INEGI]. (1952). *Séptimo Censo General de Población. 6 de junio de 1950. Estado de Guanajuato*. Obtenido de INEGI Publicaciones: <https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825412203>

Instituto Nacional de Estadística y Geografía [INEGI]. (1963). *VIII Censo General de Población 1960. 8 de junio de 1960. Estado de Guanajuato*. Obtenido de INEGI Publicaciones: <https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825412876>

Instituto Nacional de Estadística y Geografía [INEGI]. (1971). *IX Censo General de Población 1970. 28 de enero de 1970*. Obtained from INEGI Publications: <https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825413279>

Instituto Nacional de Estadística y Geografía [INEGI]. (1988). *X Censo General de Población y Vivienda 1980*. Obtained from INEGI Publications: <https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825415563>

Instituto Nacional de Estadística y Geografía [INEGI]. (1990). *XI Censo General de Población y Vivienda 1990*. Obtained from INEGI Publications: http://internet.contenidos.inegi.org.mx/contenidos/productos/prod_serv/contenidos/espanol/bvinegi/productos/historicos/1290/702825415938/702825415938_1.pdf

Instituto Nacional de Estadística y Geografía [INEGI]. (1995). *Conteo de Población y Vivienda 1995: Resultados definitivos*. Obtained from INEGI Publications: https://www.inegi.org.mx/contenidos/productos/prod_serv/contenidos/espanol/bvinegi/productos/historicos/2104/702825492519/702825492519_1.pdf

Instituto Nacional de Estadística y Geografía [INEGI]. (2005). *II Conteo de población y vivienda 2005*. Obtained from INEGI Publications: https://www.inegi.org.mx/contenidos/programas/ccpv/2005/tabulados/Cont2005_NAL_Poblacion.pdf

Instituto Nacional de Estadística y Geografía [INEGI]. (2010). *Censo de Población y Vivienda 2010*. Obtained from INEGI Publications: https://www.inegi.org.mx/contenidos/programas/ccpv/2010/tabulados/Basico/01_01B_MUNICIPAL_11.pdf

Instituto Nacional de Estadística y Geografía [INEGI]. (2015). *Censo de número de habitantes*. Obtained from INEGI Publications: <http://cuentame.inegi.org.mx/monografias/informacion/gto/poblacion/>

Instituto Nacional de Estadística y Geografía [INEGI]. (s.f.). *Mapa de Guanajuato. División Municipal*. Obtenido de Cuéntame INEGI: http://cuentame.inegi.org.mx/mapas/pdf/entidades/div_municipal/gtomprios.pdf

Instituto Nacional de Estadística y Geografía. (2000). *XII Censo General de Población y Vivienda 2000*. Obtenido de INEGI Publicaciones: https://www.inegi.org.mx/contenidos/productos/prod_serv/contenidos/espanol/bvinegi/productos/censos/poblacion/2000/resultadosporlocalidad/INITER11.pdf

Jiménez, L., & Jiménez, W. (2015). *Turismo tendencias globales y planificación estratégica*. Bogotá: ECOE. Obtenido de <https://www.ecoediciones.com/wp-content/uploads/2015/08/Turismo.-tendencias-globales.pdf>

Kristjánsdóttir, H. (2016). Can the Butler's tourist area cycle of evolution be applied to find the maximum tourism level? A Comparison of Norway and Iceland to other OECD countries. *Scandinavian Journal of Hospitality and Tourism*, 16(1), 61-75. doi:10.1080/15022250.2015.1064325

Lee, Y., & Weaver, D. (2014). The tourism area life cycle in Kim Yujoeng Literary Village, Korea. *Asia Pacific Journal of Tourism Research*(19), 181-198. doi:10.1080/10941665.2012.735681

López, V. M. (2011). *¿El mismo modelo para siempre? Comentarios sobre el ciclo de vida del área turística a partir de la experiencia de Bahías de Huatulco (México)*. Obtenido de Seminario Internacional Renovación y Reestructuración de Destinos Turísticos Consolidados del Litoral: https://rua.ua.es/dspace/bitstream/10045/20511/1/Seminario_Renovestur_01.pdf

Michailidou, A. V., Vlachokostas, C., Moussiopoulos, N., & Maleka, D. (2016). Life cycle thinking used for assessing the environmental impacts of tourism activity for a Greek tourism destination. *Journal of Cleaner Production*, 111(B), 499-510. doi:10.1016/j.jclepro.2015.09.099

OMT. (2019). *Panorama del turismo internacional 2019*. Obtenido from: <https://doi.org/10.18111/9789284421237>

Osorio, M., Deverdum, M., Mendoza, M., & Benitez, J. (2019). La evolución de Ixtapa-Zihuatanejo, México, desde el modelo del ciclo de vida del destino turístico. *Región y sociedad*, 31. Obtenido from: <https://doi.org/10.22198/rys2019/31/1012>

Plog, S. (1973). Why Destination Areas Rise and Fall in Popularity? *The Cornell Hotel and Restaurant Administration Quarterly*. 14(4), 55-58.

Priestley, G., & Lluís, M. (1998). The post Snagstion Phase of the Resort Cycle. *Annals of Tourism Research*, 25(1), 85-111.

Puig, M. & Foronda, C. (2021). Especialización turística en destinos emergentes latinoamericanos: Explorando el algoritmo para un longevo e inclusivo desarrollo socioeconómico. *Revista de geografía Norte Grande*, (78), 299-321. <https://dx.doi.org/10.4067/S0718-34022021000100299>

Segrado, R. (2011). Etapas del ciclo de vida del destino turístico Cozumel (México). En J. F. Rebollo (Ed.), *Seminario Internacional Renovación y Reestructuración de Destinos Turísticos Consolidados del Litoral*. Alicante: Universidad de Investigaciones Turísticas; Universidad de Alicante.

Shida, O., Abdul, O., Badaruddin, M., & Azizi, B. (2015). Coastal resort life cycle: An overview of Tioman Island, Malaysia. *Tourism Planning & Development*, 12(3), 266-280. doi:10.1080/21568316.2014.947438

Soares, J. C., Gandara, J. M., & Ivars, J. (2012). Indicadores para analizar la evolución del ciclo de vida de los destinos turísticos litorales. *Investigaciones Turísticas*(3), 19-38. doi:10.14198/INTURI2012.3.02

Vena Oya, J., Castañeda García, J. A. y Rodríguez Molina, M. Á. (2021). Análisis de la dispersión del gasto turístico en destinos sobreexplotados a través del uso de nuevas tecnologías: el caso de Granada, España. *Investigaciones Turísticas* (21), pp. 106-127. <https://doi.org/10.14198/INTURI2021.21.6>

Vera, F., Palomeque, F. L., Marchena, M., & Antón, S. (2013). *Análisis territorial del turismo y planificación de destinos turísticos*. Valencia: Tirant Humanidades.

Vernon, R., & Wells, L. (1966). Internacional trade and international investment in the product life cycle. *Quarterly Journal of Economics*, 81(2), 190-207.

Yang, J., Ryan, C., & Zhang, L. (2013). Social conflict in communities impacted by tourism. *Tourism Management*, 35, 82-93. doi:10.1016/j.tourman.2012.06.002

Standardization of the driver certification processes of the company Bebidas Mundial S. de R.L. de C.V.

Estandarización de los procesos de certificación de choferes de la empresa Bebidas Mundiales S. de R.L. de C.V.

ROBLES-ARIAS, Isela Margarita†, SO-FELIX, Stephany, ROSAS-ESTRADA, Kenya Patricia and VALDEZ-GUERRERO, Raquel

Tecnológico Nacional de México / Instituto Tecnológico de la Paz, La Paz, Baja California Sur, Boulevard Forjadores De Baja California Sur 4720, CP: 23080, México.

ID 1st Author: *Isela Margarita, Robles-Arias* / ORC ID: 0000-0001-5164-156X, CVU CONACYT ID: 404596

ID 1st Co-author: *Stephany, So-Felix* / ORC ID: 0000-0001-5679-7993

ID 2nd Co-author: *Kenya Patricia, Rosas-Estrada* / ORC ID: 0000-0003-2486-6127, CVU CONACYT ID: 1116605

ID 3rd Co-author: *Raquel, Valdez-Guerrero* / ORC ID: 0000-0003-0972-0189, CVU CONACYT ID: 407004

DOI: 10.35429/EJRP.2021.12.7.22.33

Received January 20, 2021; Accepted June 30, 2021

Abstract

The purpose of this work is to standardize the certification processes for delivery and administrative drivers under the CESVI Standard at Betides Mondial's, S. de R.L. de C.V. To fulfill this objective, a mixed investigation was proposed with a design of the Deming methodology "the PDCA cycle". The specific objectives were to carry out a diagnosis to the Human Capital area to know specific data of the driver training, determine the number of drivers who are certified or not and have a driver's license, design a procedure manual that allows effective control of the certification process and participate in the current awareness campaign. The result was the standardization of the certification process, the standardization manual, Excel database, the credentialing of drivers, strengthening the "Safe Fleet" campaign

Resumen

El presente trabajo tiene como propósito estandarizar los procesos de certificación de choferes de reparto y administrativos bajo la Norma CESVI en Bebidas Mundiales, S. de R.L. de C.V. Para dar cumplimiento a este objetivo, se planteó una investigación mixta con un diseño de la metodología del Deming "el ciclo PDCA". Los objetivos específicos fueron realizar un diagnóstico al área de Capital Humano para conocer datos concretos de las capacitaciones a choferes, determinar la cantidad de choferes que están o no certificados y cuenten con licencia de manejo, diseñar un manual de procedimiento que permita llevar un control eficaz del proceso de certificación y participar en la campaña vigente de concientización. Se logró como resultado la estandarización del proceso de certificación, el manual de estandarización, base de datos en Excel, la credencialización de choferes, fortalecer la campaña de "Flota Segura"

Process standardization, Certification, Drivers

Estandarización de procesos, Certificación, Choferes

Citation: ROBLES-ARIAS, Isela Margarita, SO-FELIX, Stephany, ROSAS-ESTRADA, Kenya Patricia and VALDEZ-GUERRERO, Raquel. Standardization of the driver certification processes of the company Bebidas Mundial S. de R.L. de C.V. ECORFAN Journal-Republic of Peru. 2021. 7-12:22-33.

† Researcher contributing first author.

Introduction

It is well known that, in the workplace, the safety of all workers is of paramount importance for any company. Especially in a first-class organisation of the magnitude of Bebidas Mundiales S. de R.L de C.V., better known as The Coca-Cola Company, dedicated to the production and sale of beverages worldwide. It is backed by more than 120 years of experience that position it as the #1 beverage manufacturer. Headquartered in Atlanta, Georgia. It is currently a company that offers more than 500 brands in more than 200 countries. In addition to Coca-Cola brands, its portfolio includes some of the world's most valued beverages, such as AdeS seed-based beverages, Ayataka green tea, Dasani waters, Del Valle juices and nectars, Georgia coffee, Gold Peak teas and coffees, Honest Tea, Minute Maid juices, Powerade sports drinks, simply juices, SmartWater, Sprite, VitaminWater, and ZICO coconut water.

It began its operations in plant La Paz, B.C.S in 1994 Bebidas Mundiales, arises like warehouse, with a construction of 6 x 6 mts², giving employment in total to 16 people, receiving the product directly from La Embotelladora de Mazatlán, Sin. In 1995 it begins operations like producing plant, locating the warehouse in an area of 15 x 6 mts² it counted on a capacity of 1700 full boxes in floor, and the container of the daily sales of the routes was accommodated in the patio, because it was not counted on an adequate warehouse. Currently in 2020, it has a construction of 38,527 mts², employing 396 people in La Paz and a total of 742 employees in Franchise.

This problem arises from the need expressed by the head of the training area to have a control of driver's license validity and certification to ensure that drivers on duty have their driver's license up to date. This licence is valid for only 3 years and is granted once the candidate driver complies with the evidence required by the Standard for the certification of drivers, which guarantees that they have the necessary knowledge and skills after being trained by a certifying body to be able to rule out any type of road accident that could jeopardise the safety and integration of the workers themselves, as well as that of the public.

In the years 2014-2015 there was a 22% increase in traffic accidents and fines caused by the lack of follow-up.

In 2017, mandatory certification of drivers began, and there are currently 4 certifiers at the La Paz plant. However, in 2019, according to statistical data, 10 accident events were recorded, resulting in the company paying a deductible of \$124,880 pesos for the risk premium insurance. In 2020, the planning of the present project started.

The aim of this project is to standardise the driver certification process, formally establish internal guidelines and standards, as well as more effective control over the company's driver certification process. This work was carried out in the Human Resources (HR) department. Specifically in the area of training of 177 active drivers involved in the driving of official vehicles, as well as in the driving of light and heavy goods trucks that are responsible for the distribution of goods.

General objective

Standardisation for delivery and administrative drivers under the CESVI standard in Bebidas Mundiales, S. de R.L de C.V.

Specific objectives

1. To carry out a diagnosis of the Human Capital area in the company Bebidas Mundiales S. de R.L. de C.V. in order to know the current situation regarding driver training.
2. Determine the number of drivers who are or are not certified and have a driver's license.
3. Design a procedure manual to control the certification process.

It is necessary to guarantee the safety of driver-employees, which entails the safety of the rest of the population. The aim is to reduce the occupational risks of not being certified in order to maintain a safe fleet.

This will make it possible to control and avoid operational failures through new processes and technology to reduce traffic accidents that put the health of employees, suppliers, customers and the general public at risk, as well as to avoid the loss or theft of the goods being transported.

It is necessary to ensure that all drivers are certified and have the necessary external licence and to ensure that all vehicles leaving the CEDI and/or La Paz plant comply with the documents and scheduled maintenance. Through this project it will be possible to control and standardise the certification procedure, which includes manuals, formats, monitoring in order to control and avoid situations or failures in the procedure such as: no external licenses or expired licenses, not being certified or expired certification, speeding, no documents or maintenance in force.

Development of the model

Deming was the main promoter of the continuous improvement cycle, but in reality this cycle was defined by Shewhart who considers it as "An elementary methodological process applicable to any field of activity, with the aim of ensuring the continuous improvement of these activities" The Deming wheel or cycle is a methodological process that aims to apply to any process a cyclical action formed by four fundamental steps

P = PLAN = Plan thoroughly D = DO = Perform, carry out, do. C = CHECK = Check, verify. A = ACT = Act.

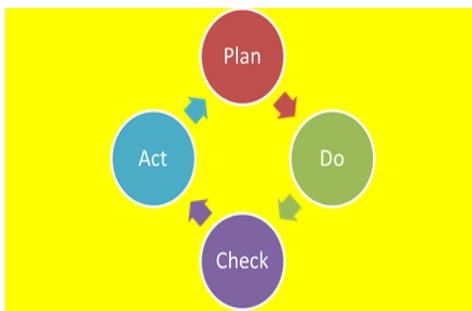


Figure 1 Representation of the PDCA cycle
Source: (Martinez, 1990)

Type of research

The research method used was a qualitative/quantitative (Mixed) analysis. This method was chosen as, according to (research, 2014) refers to the mixed method as a procedure to represent systematic, empirical, critical processes of a research and involve quantitative and qualitative data collection.

1. Planning.

At the beginning of the planning process, the instruments for data collection were selected, a schedule of activities was drawn up that helped to plan the different tasks of the diagnostic process of the company in relation to the planned deadlines, as well as to keep a better control between what was planned and what was achieved.

AREA: Capital Humano		Responsables	Semana							
No.	ACTIVIDAD		Octubre-Noviembre							
			01	02	03	04	05	06	07	
1	Reconocimiento de los choferes certificados	KPRE SSF	█							
2	Establecer los mecanismos de aplicación de instrumentos	KPRE SSF	█	█						
3	a) Planeación. Diseño de los instrumentos.	KPRE SSF			█					
4	b) Aplicación La información que se recolectara será a través de una entrevista al Jefa de C.H y encuesta a los colaboradores.	KPRE SSF			█	█				
5	c) Procesar la información	KPRE SSF					█	█		
6	d) Análisis de la información	KPRE SSF							█	█

Table 1 Timeline of activities for information gathering
Source: Own elaboration, 2020

Field research was carried out to collect data on driver certification using the following instruments.

1. Direct observation (records, historical information and evidence).
2. Direct interview with the Head of Human Capital and certifier (Structured, unstructured and mixed).
3. Survey of delivery drivers.

Design of the instrument

1. For the observation it was necessary to design a check list. See format.

CHECK LIST CERTIFICACIÓN DE CHOFERES		
SE CUENTA CON...	SI	NO
1- Registro de la plantilla laboral de la empresa		
2- Registro de plantilla laboral de choferes		
3- Curso de Certificación a choferes		
4- Registro de choferes certificados		
5- Registro de choferes con licencia vigente		
6- Instalaciones aptas para impartir el curso		
7- Certificadores disponibles para dar cursos		
8- Material de apoyo para los cursos		
9- Material de evaluación para el curso		
10- Total de colaboradores que manejan certificados		
11- Controles aptos para el seguimiento de la certificación		
12- Un responsable de dar seguimiento a las certificaciones		
13- Credencialización vigente de certificación para choferes/repartidores		

Table 2 Check list

Source: Own elaboration, 2020

2. Interview with the Head of Human Capital

Objective: To identify the certification process and active drivers in the company.

Design of the instrument

The structured technique was used, considering 12 items (period, number of participants who start the process and number who conclude it, requirements, training process, evidence of conclusion, follow-up, etc.). See format.

Instituto Tecnológico de La Paz



Interview with the Head of Human Capital

Name: X

1. What is the size of the company's workforce?
2. How many employees drive a delivery truck?
4. How many employees drive an official company vehicle?

5. Of the total number of employees who drive, how many employees are certified?
6. What is the number of employees required to be certified?
7. Who are the people in charge of certification?
8. Are there any standards that govern the monitoring of certifications?
9. What is the certification process for the company's drivers?
10. Are there any employees whose certification process is incomplete?
11. What kind of evidence do you have of certifications?
12. What kind of controls do you use for monitoring?
13. What is the rate of claims that is allowed by the social security?

Thank you very much for your time.

3. Interview with the certifier

Objective: To identify the certification process and active drivers in the company.

Design of the instrument

The structured technique was used, considering 10 items (period, number of participants who start the process and number who finish, requirements, training process, evidence of completion, follow-up, etc.). See format.

Instituto Tecnológico de La Paz



Interview with the certifier

Name: X

1. Which is the certifying body that endorses it?
2. What type of training do you provide to the drivers?
3. What is the ideal profile of the driver?
4. For how long is the certification valid for the drivers?
5. How many drivers have you trained up to now?
6. What are the most important topics covered by the certification?
7. What are the stages of the certification process?
8. What percentage of drivers successfully complete their certification?
9. What kind of certificate is given to the driver who has been certified?
10. Do you have an updated database of certified personnel?

3. Driver survey

Objective: To verify the participation and commitment of drivers to comply with the standards and processes referred to in the certification.

Instrument design

A questionnaire was designed with 12 items, using a Likert scale with 5 options that the driver chose considering his participation in the operation of the company's vehicle unit.

The categories considered were: training, vehicle handling, traffic knowledge, routes, vehicle conditions and improvements. The response options are as follows:

Affirmation
Strongly agree
Agree
Neutral
Disagree
Strongly Disagree

Table 3 Likert scale points

Source: Own elaboration

ENCUESTA PARA LOS CHOFERES DE PLANTA LA PAZ. BEBIDAS MUNDIALES. S.A DE C.V

INSTITUTO TECNOLÓGICO DE LA PAZ

Turno: _____ Fecha: _____ Tipo de transporte: |
Puesto: _____

	Totalmente de acuerdo	De acuerdo	Neutral	En desacuerdo	Totalmente desacuerdo
1. ¿Considera importante contar con su licencia de conducir vigente para ejercer su trabajo?					
2. La certificación es indispensable para poder manejar un camión oficial					
3. Considera necesaria realizar una inspección diaria al exterior para verificar las condiciones del camión.					
4. Considera necesaria verificar diario las condiciones internas del camión.					
5. Utilizo el mismo camión de reparto todos los días.					
6. Es usted consciente que el uso y mantenimiento correcto de transportes evita accidentes.					
7. Cuenta usted con experiencia en la conducción del transporte ligero y pesado.					
8. Conoce y aplica a la perfección las normas y leyes de tránsito.					
9. En caso de un accidente o situación de emergencia, ¿cuenta con los conocimientos para saber actuar de manera pertinente?					
10. La empresa me capacita de manera adecuada para el desarrollo de su labor					
11. Se encuentra motivado para desempeñar de la mejor manera su labor.					
12. ¿La empresa le da un adecuado seguimiento a su certificación?					
13. Sugerencia de mejora.					

Population and sample

A finite population size was considered for the application of the instrument.

The sample considered was the result of the application of the following formula (Morilla):

$$n = \frac{N \sigma^2 z^2}{(N-1)e^2 + \sigma^2 z^2} \tag{1}$$

$$n = \frac{72 (0.5)^2 (1.645)^2}{(72-1)(1)^2 + (0.05)^2 (1.645)^2}$$

$$n = 36$$

Where:

n= The sample size

N=Population size

σ =Population standard deviation .05

Z= Value obtained using confidence values, it is taken in relation to 90% confidence equals 1.645

e=Acceptable limit of sampling error varies between 10% (0.1) As a result of the sample a random probability sampling was used considering 36 drivers.

2.- TO DO

Diagnosis (Knowing the current situation of the company)

Direct observation

Application of the instrument

On September 7, 2020 at 4:00 pm the application of this instrument began at the facilities of Bebidas Mundiales S. de R.L. de C.V., using the check list as a tool to list the aspects that could be found and those observed. The support of Lic. X Head of Human Capital was provided for the questioning of documentary information, records and evidence that allowed the instrument to be applied.

The boss verified the evidence they had in safekeeping, which consisted of some of the company's documents.

Interview with the Head of Human Capital

Application of the interview

The interview took place on September 14, 2020 at 4:00 pm in the office of the Head of Human Capital Lic Z who was kind enough to receive us in order to proceed with the interview. In the first instance we discussed the most important points to know about the certification process, and the details that needed to be refined.

Interview with the certifier

Application of the interview

The interview took place on September 30, 2020 at 4:00 pm in the cubicle of Lic. Z. in charge of driver certification who kindly provided us with all the requested information.

Driver survey

Application of the survey

On November 11 at 7:00 am at the facilities of Bebidas Mundiales S. de R.L. de C.V., the survey was applied to the drivers of routes that started their working day in the morning shift, which was applied to a representative sample of 36 drivers according to the results of the formula. It was applied randomly. The objective of the interview was explained to them, who answered in a friendly manner and in a timely manner.

3. Check

Findings of the check-list

The data obtained are shown.

CHECK LIST CERTIFICACIÓN DE CHOFERES		
SE CUENTA CON...	SI	NO
1- Registro de la plantilla laboral de la empresa	X	
2- Registro de plantilla laboral de choferes	X	
3- Curso de Certificación a choferes	X	
4- Registro de choferes certificados	X	
5- Registro de choferes con licencia vigente	X	
6- Instalaciones aptas para impartir el curso	X	
7- Certificadores disponibles para dar cursos	X	
8- Material de apoyo para los cursos	X	
9- Material de evaluación para el curso	X	
10- Total de colaboradores que manejan certificados		X
11- Controles aptos para el seguimiento de la certificación		X
12- Un responsable de dar seguimiento a las certificaciones		X
13- Credencialización vigente de certificación para choferes/repartidores		X

Table 4 Findings from the checklist
Source: Own design So and Rosas, 2020

- Findings from the interview with the boss

The following data were obtained from the analysis of the information:

BEBIDAS MUNDIALES S.R.L DE C.V					
Total de colaboradores en planta La Paz: 450					
Colaboradores destinados a manejar un vehiculo oficial: 152					
Puesto		Puesto		Puesto	
Repartidores Universales		Repartidores venta Agua		Promotores de venta/ Coordinadores /Jefes de departamento / Areas administrativas / (72)	
Certificados	No certificados	Certificados	No certificados	Certificados	No certificados
24	0	16	0	10	62
Ayudante repartidor universal		Ayudante venta de agua			
Certificados	No certificados	Certificados	No certificados		
8	4	5	3		

Table 5 Findings interview with the boss
Source: Own design So and Rosas, 2020

Findings from the interview with the certifier

Mr. X mentioned during the interview that the certifying body is called CESVI (Centro de Experimentación y Seguridad Vial México). (Centro de Experimentación y Seguridad Vial México) which is a company that works in the prevention of traffic accidents under the required quality standards. Lic. X. is endorsed as a driving certifier for heavy and light equipment, and has been providing training on the standard to the fleet of drivers of the company Arca Continental for 15 years.

The drivers' certification is valid for 3 years, after which time re-certification is compulsory for them to continue working. At the moment, the fleet of certified drivers is covered in the routes of universal delivery drivers and water delivery drivers, a total of 30 active drivers, of which the delivery drivers' assistants are still to be certified, plus all the administrative staff who drive an official vehicle. The certification in both cases lasts 2 days, which are divided into theoretical and practical, and after finishing the syllabus, the knowledge tests are applied, with which the drivers reiterate the knowledge they have acquired.

Findings in the survey of drivers.

1. ¿Considera importante contar con su licencia de conducir vigente para ejercer su trabajo?

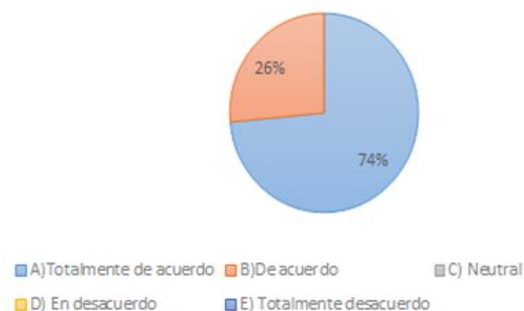


Graphic 1 Do you consider it important to have a valid driving licence to do your job?

Source: Own design So and Rosas, 2020

The result of the graphical representation showed that 95% of the drivers strongly agree with the importance of acquiring a driver's license, 5% agree with the importance of acquiring a driver's license and 5% agree with the importance of acquiring a driver's license.

2. La certificación es indispensable para poder manejar un camión oficial

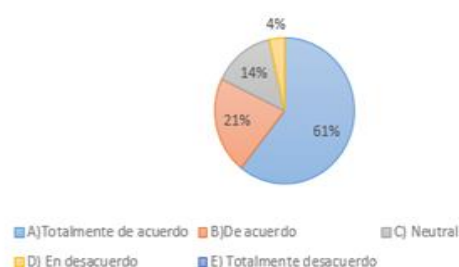


Graphic 2 Certification is a prerequisite for driving an official truck

Source: Own design So and Rosas, 2020

The graphical representation showed that 74% totally agree that certification is indispensable to operate an official vehicle, 26% agree with the certification, this indicated that there is a positive side of the drivers in obtaining the certification and the importance of keeping it.

3. Considera necesaria realizar una inspección diaria al exterior para verificar las condiciones del camión



Graphic 3 Considers it necessary to carry out a daily inspection of the exterior to verify the truck's condition

Source: Own design So and Rosas, 2020

The graphical representation showed that 61% of the drivers in Bebidas Mundiales S. R.L. de C.V. 21% totally agree with the daily inspection of the truck and its conditions, 14% neutral and 4% disagree, this indicates that the highest percentage totally agree with the inspection and only 8% disagree, it was considered that they do not see the inspection necessary, this indicated that a part of the workers would like to avoid the inspection and its conditions.

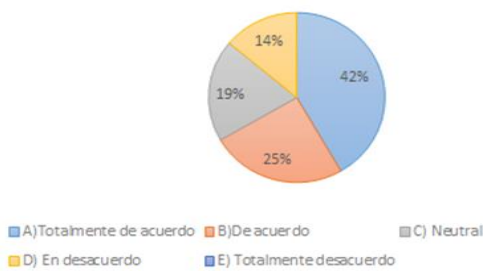
4. Considera necesaria verificar diario las condiciones internas del camión



Graphic 4 Consider it necessary to check the internal conditions of the truck on a daily basis
Source: Own design So and Rosas, 2020

The graphic representation in item 4 showed that 54% of the drivers strongly agree with checking the truck's conditions on a daily basis, 31% agree and 15% are neutral. It is considered that the drivers agree to check the conditions inside the truck in order to be able to perform their work properly and to see the internal conditions of the truck.

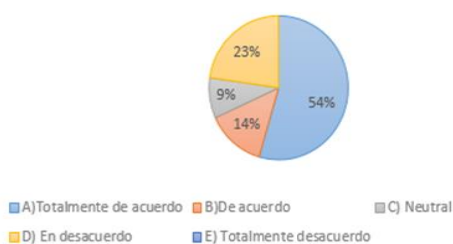
5. Utilizo el mismo camión de reparto todos los días.



Graphic 5 I use the same delivery truck every day
Source: Own design So and Rosas, 2020

The graphical representation showed that 42% of the drivers drive the same delivery truck every day with a total of agree, 25% agree, 19% neutral and 14% of the drivers disagree. This indicates that 67% of the drivers drive the same truck every day and 33% do not drive the same truck.

6. Es usted conciente que el uso y mantenimiento correcto de tranportes evita accidentes.



Graphic 6 Are you aware that the correct use and maintenance of transport avoids accidents?
Source: Own design So and Rosas, 2020

In the graphical representation it was shown that 54% of the drivers totally agree with being aware that the correct use and maintenance of trucks helps to avoid accidents, 14% agree, 9% are neutral and 23% disagree with the awareness of the correct use of trucks.

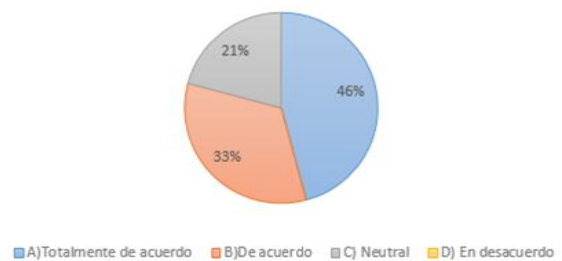
7. Cuenta usted con experiencia en la conducción del transporte ligero y pesado.



Graphic 7 Do you have experience in driving light and heavy transport
Source: Own design So and Rosas, 2020

The graphical representation of item 7 showed that 89% of the employees totally agree that they have experience in driving light and heavy transport, 11% agree, which indicates that all drivers know and master the use of a light and heavy truck vehicle.

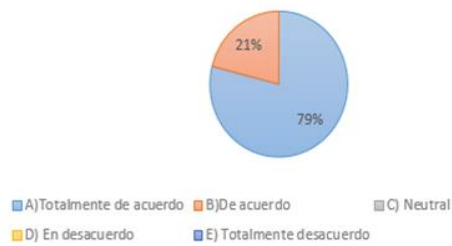
8. Conoce y aplica a la perfección las normas y leyes de transito.



Graphic 8 Knows and applies traffic rules and laws perfectly
Source: Own design So and Rosas, 2020

The graphical representation showed that 46% totally agree that they know and apply traffic rules, 33% agree and 21% are neutral, this indicated that they are not aware of the importance of respecting traffic and road rules.

9. En caso de un accidente o situación de emergencia, ¿cuenta con los conocimientos para saber de manera pertinente?

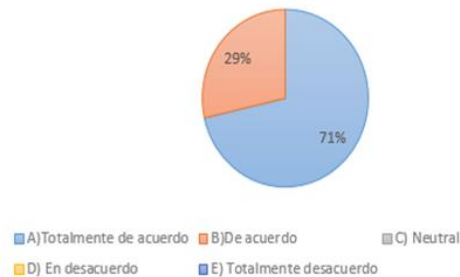


Graphic 9 In case of an accident or emergency situation, do you have the knowledge to know in a relevant way?

Source: Own design So and Rosas, 2020

The graphic showed that in item 9, 79% of the drivers agreed that they have the knowledge in case of an accident or emergency situation and 21% agreed. This indicated that the drivers know the process to follow in the event of a traffic accident.

10. La empresa lo capacita de manera adecuada para el desarrollo de sus labores.



Graphic 10 The company provides adequate training for the development of their work

Source: Own design So and Rosas, 2020

In the graphic representation in item 11 on the degree of agreement on the training given to the drivers, 71% totally agree, 29% agree. The training should be reinforced and/or strategies should be sought to reinforce the training provided to drivers.

11. Se encuentra motivado para desempeñar de la mejor manera su labor.

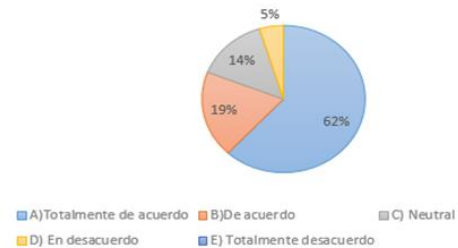


Graphic 11 They are motivated to perform their work in the best way possible

Source: Own design So and Rosas, 2020

The representation of item 11 shows that 55% of the drivers are motivated to do their job, 31% agree and 14% are neutral about being motivated.

12. La empresa le da un adecuado seguimiento a su certificación



Graphic 12 The company gives adequate follow-up to their certification

Source: Own design So and Rosas, 2020

The graphical representation of item 12 showed that 62% of the drivers strongly agree that Bebidas Mundiales S. de R.L. de C.V. gives adequate follow-up to the certification, 19% agree, 14% neutral and 5% disagree.

Dissertation of the results

Considering the results of the survey it was found that the drivers are fully aware of the importance of certification and do not show resistance to change with the new process, the incentives for motivation are covered by the company, What is found to be wrong with the findings is the lack of a check list and/or logbook for efficient control of the trucks, both internally and externally, in order to know the mechanical conditions of the vehicle fleet before leaving to cover the route, as well as a lack of awareness of accidents and their causes, and to refresh the knowledge of traffic and road rules that can be part of the training.

Analysis of the information

FORTALEZAS	OPORTUNIDADES
<ul style="list-style-type: none"> La mayor parte de la plantilla laboral de choferes se encuentra certificada hasta el momento La choferes reconocen la importancia de tener licencia y certificación vigente Los choferes cuentan con conocimientos bases para manejar adecuadamente las unidades de transporte La empresa capacita con los temas adecuados a sus choferes Se trabaja una cultura de "FLOTA SEGURA" que promueve el manejo preventivo y seguridad de los colaboradores La empresa ejerce una política de flota con lineamientos que debe de aplicar los choferes repartidores 	<ul style="list-style-type: none"> Capacitar y certificar a personal administrativo, promotores y Jefes de departamentos con el fin de tener cubierto el total de los colaboradores que conducen un vehiculo oficial Incentivar a los colaboradores a seguir desempeñando correctamente sus labores a través de recompensas Renovar el material de apoyo y evaluación de la capacitación con actualizaciones cada determinado periodo Detallar el proceso establecido para capacitar a nuevos choferes colaboradores Mejorar el sistema de control para mantener la certificación de los choferes
DEBILIDADES	AMENAZAS
<ul style="list-style-type: none"> Los conductores no cuentan con una credencial que avale su certificación e indique su fecha de vencimiento Existen casos de choferes que no han concluido el proceso de certificación No existe una persona responsable para llevar el seguimiento de las certificaciones con respecto a las fechas de vencimiento 	<ul style="list-style-type: none"> De continuar con la plantilla laboral no certificada en su totalidad se incrementa la tasa de riesgos y accidentes de trabajo Pérdida, destrucción o robo de mercancía debido a accidentes viales Ser acreedor de multas y sanciones por no tener licencia vigente Deterioro de la flota vehicular por falta de mantenimiento preventivo por parte de los choferes

Table 6 SWOT
Source: Own design, 2020

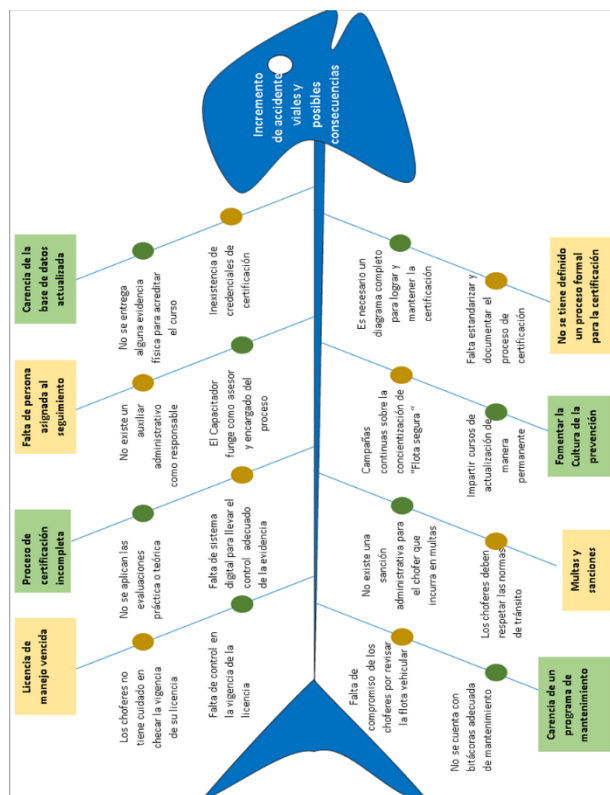


Figure 2 Cause and Effect Diagram
Source: Own design (So and Rosas, 2020)

Results

Tools are presented which, if implemented, will help to solve the problem of the certification process of Bebidas Mundiales S. de R.L. de C.V. drivers.

The tools are:

1. Manual of the certification procedure for drivers.

Manual del procedimiento de certificación de choferes Bebidas Mundiales S. de R.L. de C.V.



Versión 1.0
La Paz B.C.S, a 16 de diciembre del 2020

2. Credentialing of La Paz and Agua planta

La Paz route drivers as an improvement tool to prevent the use of official vehicles without driver certification and to ensure continuity of driver's licence validity and certification.



Figure 3 Driver credentialing
Source: Own design So and Rosas, 2020

3. Software to control and monitor the certification process

A software was designed in the Microsoft Office system in the Excel programme where all the drivers who are certified and/or recertified were registered and filtered. It contains the driver's full name, control number, position, site, work area, personnel area, licence data, licence validity, type of vehicle he/she can drive, days remaining before expiry,

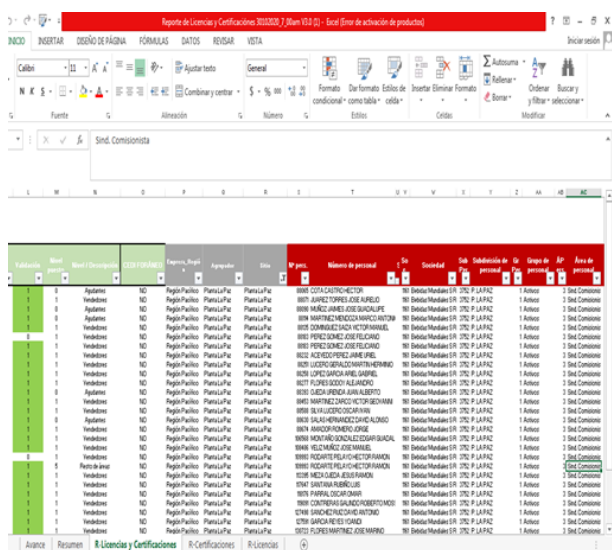


Figure 4 Software to control and monitor the certification process
Source: Own design So and Feliz, 2020

4. Programme campaign where importance is given to strengthen the safe fleet programme

SAFE FLEET MANAGEMENT AWARENESS CAMPAIGN

Objective: To raise awareness among employees of the responsible handling of official vehicles

Target group: Drivers, promoters and driver's assistants
Tools: Posters, Computer equipment, Notebook and pen
Campaign operation: <ol style="list-style-type: none"> 1. Posters will be placed at strategic points where employees can become aware of the information 2. A complaints and/or suggestions box will be set up for employees who have new opinions. 3. A weekly meeting will be held with the head of human capital, safety supervisor and heads of area to verify that the certifications are still in force to protect the safety of their workers.
Timeframe to be implemented: the campaign will be permanent from the beginning, as it is intended that social service students will support the follow-up of the campaign.





Figure 4 Safe fleet management awareness campaign
Source: Coca Cola, 2021

Conclusions

These tools are designed based on information obtained from the company's diagnosis.

As a result of this work, the design of tools such as formats, diagrams, procedure manuals, among others necessary to achieve the certification and validity of drivers was achieved with the aim that in the event that it is implemented in the company, the following benefits will be achieved:

ISSN-On line: 2414-4819
ECORFAN® All rights reserved.

For the company.

1. Ratify the commitment of the company's senior management to the certification process for its drivers.
2. Strengthen the corporate image of the company.

Workers.

3. The aim is that the drivers know and apply their responsibilities in a formal way in order to achieve an efficient performance in their work.
4. To reduce the risks in accidents and during the operation of the units.
5. Genuine interest in remaining current in certification.

General.

6. Encourage and stimulate respect for traffic and road rules.

Recommendations

Design a monitoring and surveillance programme for the certification process.

Design and implement a preventive and corrective maintenance logbook for transport units.

The provisions of the manual are observed and applied unrestrictedly.

To integrate file by driver with the necessary evidences referring to its certification.

References

- Investigacion, M. d. (2014). *Hernandez Sampieri*. Mexico: Trillas.
- Martinez, G. M. (1990). *Fundamentos de Administracion*. Mexico: Trillas.
- Morilla, A. (s.f.). Muestreo en poblaciones finitas. En B. Diaz, *apuntes* (pág. 30).

Distributed generation with a photovoltaic generating plant interconnected to a medium voltage network in the marginalized town of Xbilincoc, Campeche

Generación distribuida con central generadora fotovoltaica interconectada a red de media tensión en el poblado marginado de Xbilincoc, Campeche

LEZAMA-ZÁRRAGA, Francisco Román†, CHAN-GONZALEZ, Jorge de Jesús, SHIH, Meng Yen and SALAZAR-UITZ, Ricardo Rubén

Universidad Autónoma de Campeche, Campus V, Predio s/n por Av. Humberto Lanz Cárdenas y Unidad Habitacional Ecológica Ambiental, Col. Ex-Hacienda Kala, CP 24085, San Francisco de Campeche, Cam., Mexico.

ID 1st Author: *Francisco Román, Lezama-Zárraga* / ORC ID: 0000-0003-3397-7881, Researcher ID Thomson: U-1229-2018, CVU CONACYT ID: 205493

ID 1st Co-author: *Jorge de Jesús, Chan-Gonzalez* / ORC ID: 0000-0002-8638-1646, CVU CONACYT ID: 84196

ID 2nd Co-author: *Meng Yen, Shih* / ORC ID: 0000-0001-7475-6458, CVU CONACYT ID: 408617

ID 3rd Co-author: *Ricardo Rubén, Salazar-Uitz* / ORC ID: 0000-0003-2307-737X, CVU CONACYT ID: 416277

DOI: 10.35429/EJRP.2021.12.7.34.42

Received January 25, 2021; Accepted June 30, 2021

Abstract

In this paper, it is proposed to lay the foundations for the implementation of a Photovoltaic Systems Interconnected onto Network Distribution Systems that benefits the marginalized population of the town of Xbilincoc, Campeche. Through Distributed Generation (DG) it will be possible to direct the electrical energy produced by this plant for its own consumption and / or sale to the electrical company denominated Comision Federal de Electricidad (CFE), depending on the analysis of consideration for services that is most convenient for the producers. The power generating plant will be managed by the fishing cooperative formed by the commissioner and the most active fishermen of the town and the economic resources necessary for its construction and commissioning will be through a financing mechanism granted by a governing body denominated Fideicomiso de Ahorro de Energía (FIDE) and when it has been paid in full, the economic benefits for families will be to ensure that the cost of their consumption of electric energy does not increase, and to strengthen the economic development of the town of Punta Xen by administering the resources obtained from the sale of electrical energy to the CFE.

Distributed generation, Self-consumption, Marginalized population

Resumen

En este artículo se propone el proyecto para la implementación de un Sistema Fotovoltaico Interconectado a Red (SFVIR) que beneficie a la población marginada de la localidad agrícola de Xbilincoc, Campeche. A través de la Generación Distribuida (GD) será posible direccionar la energía eléctrica que produce esta planta para su autoconsumo y venta de los excedentes a la Comisión Federal de Electricidad (CFE), dependiendo del análisis de contraprestación de servicios que le sea más conveniente a los productores. La planta generadora será administrada por la cooperativa agrícola formada por el comisario y agricultores más activos del poblado y los recursos económicos necesarios para su construcción y puesta en servicio serán a través de un mecanismo de financiamiento otorgado por el Fideicomiso de Ahorro de Energía (FIDE) y cuando ya se haya pagado en su totalidad, los beneficios económicos serán para las familias asegurando mantener energía eléctrica en los hogares sin costo y lograr fortalecer el desarrollo económico del poblado mediante la administración de los recursos obtenidos de la venta de la energía eléctrica a la CFE.

Generación distribuida, Autoconsumo, Población marginada

Citation: LEZAMA-ZÁRRAGA, Francisco Román, CHAN-GONZALEZ, Jorge de Jesús, SHIH, Meng Yen and SALAZAR-UITZ, Ricardo Rubén. Distributed generation with a photovoltaic generating plant interconnected to a medium voltage network in the marginalized town of Xbilincoc, Campeche. ECORFAN Journal-Republic of Peru. 2021. 7-12:34-42.

† Researcher contributing first author.

Introduction

This article proposes the design and implementation of a photovoltaic power plant interconnected to the distribution network of the Federal Electricity Commission (CFE) in the rural town of Xbilincoc, Hopelchén, Campeche in order to provide electricity to households for self-consumption and to market part of that energy through its sale to the Federal Electricity Commission. This energy will be used for daily household chores and the surplus that is not consumed will be sold to the CFE to obtain economic resources that will be invested in the installation of public services in the town in order to improve the quality of life of the inhabitants.

Through the Rural Electrification Department, the CFE will build a 4.5 km-long branch of the distribution line to supply medium voltage to the town and will build the internal 34500/220-127 V distribution network. Through the Distributed Generation concept, the village will have quality electric power on site because the energy will not travel long distances from generation to the point of consumption, thus eliminating line losses.

Problem statement

The town of Xbilincoc, in the municipality of Hopelchén, in the State of Campeche is a marginalized population that currently does not have public electricity service, its only source of electricity consumption is through individual photovoltaic panels of 180 W, of which 3 panels are installed per house, which is insufficient to cover the basic needs of the inhabitants.

In terms of electricity consumption, the houses only have a few incandescent bulbs, fluorescent bulbs, and a small refrigerator.

There is a history of using isolated photovoltaic panels in the community in 2006; however, due to the lack of maintenance and training for the villagers, the batteries and other accessories were damaged, causing the system in each home to function inefficiently and in some cases to fall into disuse. The Federal Electricity Commission's power grid is located approximately 4.5 km from the town and the authorities have taken steps over the years to get the CFE to supply electricity, but so far these efforts have not been successful.

As a result of the above, it is proposed to implement an electric power generating plant with a photovoltaic system interconnected to the grid (SFVIR) and thus cover and satisfy the basic socioeconomic needs of the population. With the operation of the SFVIR, through an agricultural cooperative scheme, acting as an Independent Power Producer (IPP), it will be possible to generate and sell electricity to a Qualified Supplier and this in turn, will sell it to the CFE Basic Supply and the capital obtained from sales for economic growth will be used to promote employment and sustainable development of the population, which will contribute to the population to have a better quality of life, and better productivity in their main local activity that they currently develop as agriculture.

In Mexico we have the opportunity to take advantage of renewable natural resources to develop technologies and create generating power plants with lower capacity and higher efficiency than conventional power plants, which is a very attractive alternative both technically and economically. There are also many public financing mechanisms such as FIDE, CONUEE, GIZ, FOTEASE, FSE, FSUE, etc., that grant credit or financing through development projects to combat poverty, creating links between States, Municipalities and the Federal Government to establish agreements and conventions.

It is an opportunity for the town of Xbilincoc to achieve this, so the villagers must be made deeply aware of its implementation and the socioeconomic benefits that will be obtained for them and for the environment.

Theoretical framework

The legislation on electric energy has evolved in recent years, from only allowing the monopoly of the CFE, to the new legislation implemented in 2016 that allows the participation of private companies in the Wholesale Electricity Market (MEM) to promote competition between Producers and Marketers and thus break the monopoly of the CFE.

In the previous legislation, i.e., with the Electric Energy Public Service Law (LSPEE), there was the figure of the Independent Power Producer (PIE), who was only allowed by the energy regulator, the Energy Regulatory Commission (CRE), to sell its electric energy to the CFE.

Now with the new Electricity Industry Law (LIE), the figure of Prosumer appears, which is a PIE that uses the energy it generates for self-consumption, cogeneration and sale to the CFE. Another advantage of this new legislation is that the Prosumer can generate energy in High, Medium or Low Voltage, so that a low voltage user can now be a low voltage producer. The Prosumer can be a natural person or an organization (small or medium company) named as a legal entity. Both have the same possibilities to consume or sell the electricity they produce in the Wholesale Electricity Market (MEM).

The greatest growth potential for the new energy generation scheme is in solar energy with photovoltaic systems. Industrial, small and medium-sized companies in the country are on the way to producing the energy they consume; however, the lack of financing and the slow return on investment discourage this important generation alternative.

In Mexico there are 4.2 million economic units (Secretaría de Economía, 2019), of which 99.8 percent of them are small or medium-sized enterprises (SMEs) that contribute 42 percent of the gross domestic product and generate 78 percent of employment in the country.

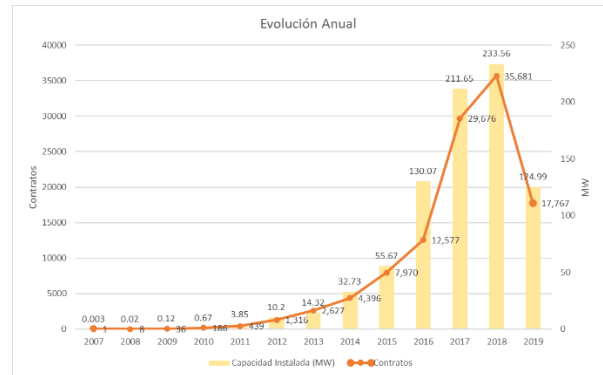
In March 2019, the CRE disclosed that there are 94,844 such rooftops in Mexico, with a total capacity of just over 692 Megawatts (MW). In 2018 alone, more than 35 thousand were installed, representing a 60 percent growth in the country in one year. For distributed generation (DG), these contracts contemplate an installed capacity of 570.20 MW, while those of small and medium scale reached 247.65 MW. This is shown in Table 1.

Likewise, the migration towards Distributed Generation can be seen in Graph 1, with the increase in installed capacity and in the contracts granted to the PIEs.

By state, Jalisco, with 17,97 thousand 97; Nuevo León, with 11,45 thousand 45; and Mexico City, with 7,376, were the states with the highest number of contracts.

	Installed capacity (MW)	Contracts (Thousands)
Small and medium scale	247,65	29.556
Distributed Generation	570,2	83.104
	817,85	112.660

Table 1 Annual evolution of small and medium scale contracts and Distributed Generation
 Source: Energy Regulatory Commission, March 2019



Graphic 1 Annual evolution of installed capacity/contracts, according to CFE's subsidiary productive company data
 Source: Energy Regulatory Commission, March 2019

By installed capacity, Nuevo León, with 91.34 MW; Jalisco, with 88.86 MW; State of Mexico, with 74.83 MW; as well as Mexico City, with 64.68 MW, were the most relevant entities in 2018.

It is important to consider that, in the years 2019 and 2020, this growth has been slowing down, justifying that Distributed Generation with clean energies, such as wind and solar photovoltaic are intermittent and do not provide reliability to the National Electric System (SEN). Examples of restrictions are the CENACE and SENER agreements of April 29 and May 15, 2020 (SEGOB, 2020) due to the issue of the energy counter-reform. In addition, the issue of the Sars-CoV2 virus pandemic (Covid-19) contributed to the decrease in the execution of contracts by the CFE.

In Distributed Generation, there are generating plants with fossil and clean energies. Table 2 shows that the smallest generating plants are hydroelectric, gas, biomass, diesel or fuel oil, wind and biogas, while the largest generating plant is solar photovoltaic.

Technologies	Capacity (MW)	No. Contracts	Percentage (%)
Hydroelectric plants	0,009	4	0
Gas	0,077	9	0,01
Biomass	0,81	10	0,1
Diesel or Fuel Oil	0,72	13	0,01
Wind power	0,19	19	0,02
Biogas	3,97	49	0,49
Solar Photovoltaic	812,6	112.500	99,3

Table 2 Scheme of participation of technologies, in terms of capacity, contracts and percentage

Source: Energy Regulatory Commission, March 2019

Methodology

For this project, a methodology was used, starting with a socioeconomic analysis of the population, followed by a load census, then a planning of the distribution network within the village along with the interconnection branch, the solar photovoltaic plant was sized and finally a cost analysis that is presented to the Energy Saving Trust Program (FIDE) to obtain funding for the solar photovoltaic plant with its payback time in order to verify the time in which the benefits will already be for the population.

The purpose of this study is to lay the groundwork so that other marginalized populations can access financing and rural electrification programs in order to become electricity prosumers that participate in the Wholesale Electricity Market and obtain economic benefits that increase their quality of life.

Distributed generation and the grid code

DPCA (Distribution Power Coalition of America) defines it as any small-scale generation technology that provides electricity at points closer to the consumer or to the transmission or distribution grid. On the other hand, the IEA (International Energy Agency) considers as DG only that which is connected to the distribution grid at low voltage and associates it with technologies such as engines, mini- and micro-turbines, fuel cells and solar photovoltaic energy. Under this scheme, the SFVIR will be efficient.

The Connection Provisions of the Grid Code are applicable to all Load Centers connected at Medium and High Voltage. The above, regardless of the contracted demand, i.e., compliance with the Grid Code is not differentiated for Basic Supply users, Qualified, Qualified Wholesale Electricity Market Participant Users, Intermediary Generation, prosumers, etc. Our SFVIR must comply with these requirements in order to be interconnected to the National Electric System.

Socioeconomic status and load census

The occupation of 100% of the heads of household is farmer, and their average income is very low, between \$4500.00 and \$7500.00 per month (source: the villagers themselves and the commissioner), so they do not have a fixed income or insurance to provide welfare for their families. The average family consists of 6 people: father, mother and 4 children, so the economic income is insufficient. Many young people and some heads of household have had to migrate to nearby towns in search of work. In addition, they lack public electric power services, which is why it is necessary to give them the opportunity to build and let them manage the photovoltaic generating plant, after training and commissioning.

A study was made of the houses that have electric energy service from the three old panels they have. This is shown in the following table.

No. of dwellings	100W incandescent bulb	54 W fluorescent lamp	700 W refrigerator
19	zero	4	1
11	2	2	1
4	4	zero	zero

Table 3 Results of the census of electrical load in dwellings

Source: Own elaboration

As can be seen in both studies, the families do not have sufficient economic resources to support themselves and, in addition, they lack efficient public electricity service, and there is no public lighting, making it dangerous for people to pass through at night.

Distribution network in the village

Through the Rural Electrification Department of the CFE and the authors of this article, the project of the Distribution Network of the town of Xbilincoc was elaborated, who will bid the contest for its construction. Table 4 below shows some of the structures, devices and conductors to be installed.

Airborne equipment chart				
No.	NEW POST	DEVICES		
		MEDIA	RETENTIONS	LANDS
1	12-750	AD3G/3RF3A	2-RDA	TIE
2	12-750	TS3N		
3	12-750	TS3N/RD2	RDA	TIE
4	12-750	AD2N	RDA	
5	12-750	TS3N		
6	12-750	RD2N/RD2	RDA-REA	TIE
7	12-750	TS3N		
8	12-750	RD2N/RD2	RDA-REA	TIE

Table 4 Sample of some structures, devices and conductors of the distribution network in the town of Xbilincoc

Source: Own elaboration

Distribution Branch for the village

The CFE distribution circuit that will feed the town is called Ukúm (Circuit CMO05030) with a voltage of 34.5 kV, but it is 4.5 km from the interconnection point of the town, so it is required to build a feeder branch for the town. In the same way as the village distribution network, this branch will be built with resources from the Rural Electrification Department of the CFE. Table 5 shows some of the structures, devices and conductors to be installed.

Airborne equipment chart				
No.	NEW POST	DEVICES		
		MEDIA	RETENTIONS	LANDS
1	13C-600	CT1G/CT2		
2	13C-600	HA3G	2RDA 2RSA	1
3	13C-600	CT1G/CT2		
4	13C-600	CT1G/CT2		1
5	13C-600	CT1G/CT2	TEMPESTAD	
6	13C-600	CT1G/CT2		1
7	13C-600	CT1G/CT2		

Table 5 Sample of some structures, devices and conductors of the distribution branch of the Xbilincoc village

Source: Own elaboration

The Photovoltaic Generating Station and its photovoltaic arrays Due to the need for electrical energy in the houses of the town of Xbilincoc, 4 PV modules of 440 Wp were considered for each house, so there will be a load of 1.76 kW per household. There are 34 homes in total, so the power demand of the village will be

$$P_{town} = 440 W_p \cdot 4 \text{ modules} \cdot 34 \text{ homes} = 59,840 W \quad (1)$$

And thinking of producing 50% more for direct sale to CFE, we will have:

$$P_{Total} = 150\% P_{town} = 1.5(59,840 W) = 89,760 W = 89.76 k \quad (2)$$

The number of PV modules is obtained from:

$$No. \text{ modules } FV = \frac{89,760 W}{440 W} = 204 \text{ modules} \quad (3)$$

In our design, three 24 kW PV arrays and one 17.5 kW array are proposed. Each 24-kW array will have strings of 14 modules (440 W each) in series and two strings in parallel for each MPPT. The inverter has 2 MPPTs. Therefore, each inverter will have 56 modules. A FRONUIS SYMO 24.0-3 480 inverter is proposed for each array.

The 17.5 kW array will have strings of 20 modules (440 W each) in series for each MPPT. The inverter has 2 MPPTs. Therefore, the inverter will have 40 modules. A FRONUIS SYMO 17.5-3 480 inverter is proposed for this array.

Electrical characteristics					
Power (Wp)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Efficiency (%)
440	48.7	40.3	11.4	10.92	19.92
Mechanical and physical characteristics					
Cell type	Cell arrangement	Dimensions (mm)	Weight (kg)	Module temp. (°C)	Air mass
Polycrystalline, Generation III	2x (12x6) (144 cell)	2108x1048x40	24.9	25	1.5

Table 6 Electrical and mechanical characteristics of the PV module

Source: own elaboration

Selection of the photovoltaic module

A polycrystalline photovoltaic module, CanadianSolar brand, model HiKu SUPER HIGH POWER POLY PERC MODULE of 440 W, with the characteristics shown in Table 6, is proposed.

Inverter selection

The inverter for the solar PV plant is selected. On this occasion, an inverter is proposed that meets the DC requirements of the PV arrays shown above and the mppt connection points, in addition to the AC requirements. For the 3 arrays of 24 kW, three-phase central inverters for interconnection to the grid of FRONIUS model SYMO 24.0-3 480 have been selected, with the characteristics shown in Table 7.

Inverter Fronius Sympo 24.0-3 480						
PV Power (kWp)	Number of MPPT	Total usable input current (MPPT1+MPPT2) (A)	Maximum I _{cc} per PV series (A)	V _{cd} MPP range (V)	AC output voltage (V)	AC output current (A)
19 – 31	2	51	49.5/37.5	500 - 800	480	28.9

Table 7 Input and output electrical characteristics of the PV inverter

Source: Own elaboration

Similarly, for the 17.5 kW array, the inverter for the solar PV plant is selected. An inverter is proposed that meets the DC requirements of the PV arrays and the mppt connection points, in addition to the AC requirements. Three-phase central inverters have been selected for interconnection to the grid, FRONIUS model SYMO 17.5-3 480, with the characteristics shown in Table 8.

Fronius Sympo 22.7-3 Inverter 480						
PV Power (kWp)	Number of MPPT	Total usable input current (MPPT1+MPPT2) (A)	Maximum I _{cc} per PV series (A)	V _{cd} MPP range (V)	AC output voltage (V)	AC output current (A)
14.0 – 23.0	2	51	49.5/37.5	500 - 800	480	21.0

Table 8 Input and output electrical characteristics of the PV inverter

Source: Own elaboration

Calculation of conductors

The calculation of the feeder that goes from the distribution board to each inverter was performed. For each inverter that controls 56 PV modules, we have:

$$I_{nom} = \frac{P}{\sqrt{3}V_L \cos\theta} = \frac{24640}{\sqrt{3}(480V)(0.9)} = 32.93 A$$

We calculated the Corrected I_{corrected}, taking the following factors to comply with NOM-001-SEDE-2012: T.C.F. = Temperature correction factor = 0.88, D.F. = Demand factor = 1.0 and A.C.F. = Clustering correction factor = 1.0.

$$I_{corr} = \frac{I_{nom}(F.D.)}{(F.C.T.)(F.C.A.)} = \frac{32.93A(1)}{(0.88)(1)} = 37.42 A$$

According to table 310-15(b)2(a) of NOM-001-SEDE-2012 on the ampacity of conductors, we have a feeder that has a nominal temperature of 75° C THHW caliber 8 AWG, with an ampacity of 50 Amperes and a cross section of 8.37 mm². We verify that it meets the voltage drop criterion, taking the distance of the inverter farthest from the distribution board, which is 38 m. and we have:

$$\%e = \frac{2\sqrt{3} L I_{nom}}{s V_f} = \frac{2\sqrt{3}(38m.)(32.93 A)}{(8.37 mm^2)(480V)} = 0.028\% < 3\%$$

According to our calculation, the 8 AWG gauge THHW conductor complies with NOM-001-SEDE-2012 for the positive and negative poles. Also for the inverter controlling 40 PV modules the same gauge was considered.

Calculation of the protections

The thermomagnetic circuit breaker for each of the three 56-module PV arrays was obtained from:

$$I_{max} = I_{protection} = 125\% I_{nom} = 1.25 (32.93 A) = 41.16 A$$

Three **3P-50 Amperes** thermomagnetic circuit breakers, **type I-Line**, are required.

For the inverter of 40 PV modules, we have:

$$I_{nom} = \frac{P}{\sqrt{3}V_L \cos\theta} = \frac{17600}{\sqrt{3}(480V)(0.9)} = 23.52 A$$

With a switch of:

$$I_{max} = I_{protection} = 125\% I_{nom} = 1.25 (23.52 A) = 29.4 A$$

One **3P-30 Ampere** thermal magnetic breaker, **type I-Line**, is required.

The main switch of the I-Line panel shall be of:

$$I_{nom} = 3(32.93 A) + 1(23.52 A) = 122.31 A$$

Also:

$$I_{nom} = \frac{P}{\sqrt{3}V_L \cos\theta} = \frac{89760}{\sqrt{3}(480V)(0.9)} = 122.31 A$$

The main switch will be:

$$I_{max} = I_{protection} = 125\% I_{nom} = 1.25 (122.31 A) = 152.88 A$$

One **3P-175 Ampere** thermal magnetic breaker, **type I-Line**, is required.

The Distribution Panelboard shall be three-phase I-Line type with its 3P-175 and 32-space main breaker, model JG250M141B in Nema-1 enclosure.

Transformer rating and fuse strip

To obtain the transformer capacity, 15% free for future loads is considered, and is given by:

$$kVA = 115\% \frac{kW_p}{\cos\theta} = 1.15 \left(\frac{89.76 \text{ kW}_p}{0.9} \right) = 114.69 \text{ kVA}$$

Therefore, a three-phase distribution transformer of 150 kVA, 480-254/34,500 V. step-up, Star-Delta connection, with overvoltage protection based on three ADA 33 kV surge arresters is required.

The CFE Medium Voltage connection will be aerial type, with 2 AWG AAC conductor, with 3 fuse cutouts (CCF) for 34.5 kV and with fuse strip of:

$$I_{primary} = \frac{P}{\sqrt{3}V_L \cos\theta} = \frac{89760}{\sqrt{3}(34500 \text{ V})(0.9)} = 1.66 \text{ A}$$

Three 2 Amp fuse strips are required.

Figure 1 illustrates the arrangement diagram of the 89.76 kWp generating station.

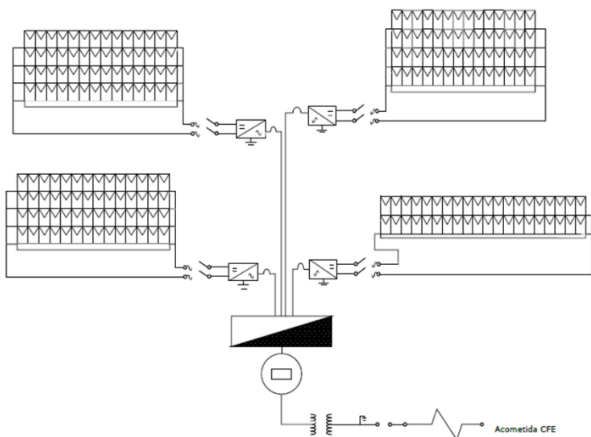


Figure 1 SFVIR to operate as distributed generation
Source: own elaboration.

Cost and financing of the photovoltaic generating plant

For the construction of the photovoltaic power plant, financing was requested from the Fideicomiso de Ahorro de Energía (FIDE), which will provide the capital for the total cost of the SFVIR in the amount of US\$91,829.84 through a contract between the Federal Government's Proyecto Servicios Integrales de Energía (PSIE) and the fishermen's cooperative, of which approximately US\$45,914.92 would be provided by the Federal Government as an "investment" subsidy. The PSIE was designed to support rural electrification strategies and measures established by the Secretariat of Energy (SENER) and defined as a priority by the federal administration.

Projected production of energy generated and its benefits

Table 9 shows an estimate of the monthly energy generation projection. The production depends on the solar resource, given in average monthly peak solar hours, and the number of days in the month.

The monthly solar resource data was obtained from NREL (The National Renewable Energy Laboratory). The annual energy generated will be 193,865.42 kWh per year under ideal conditions; but in reality the actual weather conditions vary with the weather, there are cloudy days, rainy days, some garbage falling on the PV modules, among other inconveniences, so it is considered empirically a 20% loss (Weber, *et al.*, 2020), giving an annual energy generation of 155,092.33 kWh.

Month	kWp installed	Peak solar hours	Days per month	kWh generated per month
January	89.76	5.25	31	14,608.44
February	89.76	5.86	28	14,727.82
March	89.76	6.48	31	18,030.98
April	89.76	6.52	30	17,557.05
May	89.76	6.30	31	17,530.12
June	89.76	6.01	30	16,183.73
July	89.76	6.06	31	16,862.32
August	89.76	6.15	31	17,112.74
September	89.76	6.11	30	16,453.01
October	89.76	5.76	31	16,027.54
November	89.76	5.58	30	15,025.82
December	89.76	4.94	31	13,745.85
			Annual production	193,865.42

Table 9 Monthly projection of energy generation
Source: Own elaboration

Let us remember that, of this production, approximately 50% will be sold to the CFE, under the NET BILLING scheme and will be in accordance with what is registered in the bi-directional meter per month. The electric energy generated with renewable energies and sold to the CFE has a price between 80 and 120 dollars per MWh (SENER, 2020). Being solar photovoltaic the cheapest, we will take the price of 80 dollars per MWh and this gives us an estimated annual economic resource of

$$\text{Annual amount} = 50\% \text{ Annual production in MW} \cdot \left(80 \frac{\text{dollars}}{\text{MW}}\right)$$

$$\text{Annual amount} = 0.5(155.092 \text{ MW}) \left(80 \frac{\text{dollars}}{\text{MW}}\right) = 6203.68 \text{ dollars}$$

This capital will be used to be applied in two areas:

1. 50% will be used to pay the financing granted by the PSIE for the implementation of the photovoltaic power plant, so they would stop paying the investment in 7.4 years and from then on, the net sales will be for the villagers.
2. The other 50% will be used to improve the quality of life of the families of Xbilincoc, through the implementation of public services and social programs that support the well-being of the families.

The energy will be sold to a qualified supplier who will sell it to the CFE. With the implementation of the photovoltaic power plant, the town of Xbilincoc will emerge from marginalization, thanks to the support provided by CFE Rural Electrification, PSIE and the project developed in this article.

Conclusions and recommendations

The project developed provides a methodology for the implementation of a Photovoltaic System Interconnected to the Grid through Distributed Generation in marginalized populations, this project includes a branch and a distribution network to supply electric energy in Medium and Low Voltage to the town of Xbilincoc, Hopelchén, Campeche. This photovoltaic power plant will bring well-being and progress to the families of the town and will be built with subsidized financing from the Federal Government.

The calculations and considerations made to obtain the capacity and all the elements of a SFVIR are a methodology with important and conclusive results for companies in the industrial, commercial, residential and service sectors to join the Wholesale Electricity Market as prosumers.

Future research areas identified in this article are:

- Define a methodology for prosumers to comply with the requirements of the Grid Code.
- Implement a methodology for the commissioning of a SFVIR.
- Implement a preventive maintenance program for a SFVIR in marginalized populations.

References

- Cámara de Diputados. 2017. “Reglamento de la Ley de Transición Energética”. Art. 12. Retrieved from: http://www.diputados.gob.mx/LeyesBiblio/y/Reg_LTE_040517.pdf
- Carbajal Quintero, S. X., & Marín Jiménez, J. D. 2013. *Impacto de la generación distribuida en el sistema eléctrico de potencia colombiano: un enfoque dinámico*. Revista Dialnet, Tecnura. Vol. 17, No. 35, pp. 77 – 89.
- Centro Nacional de Control de Energía. 2020. *ACUERDO para garantizar la eficiencia, calidad, confiabilidad, continuidad y seguridad del Sistema Eléctrico Nacional, con motivo del reconocimiento de la epidemia de la enfermedad por el virus SARS-CoV2 (COVID-19)*. 29 April 2020. Retrieved from: <https://www.cenace.gob.mx/Docs/MarcoRegulatorio/AcuerdosCENACE/Acuerdo%20para%20garantizar%20la%20eficiencia,%20Calidad,%20Confiabilidad,%20Continuidad%20y%20seguridad%20del%20SEN%202020%2005%2001.pdf>
- Comisión Federal de Electricidad. 2016. “Postes de concreto; especificación CFE J6200-03”, Retrieved from: https://lapem.cfe.gob.mx/normas/carga_pagina.asp?pag=J6200-03.pdf

Comisión Federal de Electricidad. 2019. “*Apartarrayos para líneas aéreas de transmisión de corriente alterna de 161 kV a 400 kV; especificación CFE 52100-93*”. Retrieved from:

https://lapem.cfe.gob.mx/normas/carga_pagina.asp?pag=52100-93.pdf

Comisión Federal de Electricidad. 2019. “*Cuchillas seccionadoras en aire de 15 kV a 145 kV con automatismo inteligente; especificación CFE V4200-73*”, August 2019. Retrieved from:

https://lapem.cfe.gob.mx/normas/carga_pagina.asp?pag=V4200-73.pdf

Cóndor Lucchini, H. (2021). Generación distribuida con energías renovables en Perú.

Elba Mendoza. 2019. Energy Management Magazine. *Generación Distribuida para PYMES*, Año 7, No. 3, páginas 26-31.

Gobierno de México, Secretaría de Medio Ambiente y Recursos Naturales. 2020. Retrieved from:

<https://www.gob.mx/semarnat/prensa/mexico-reitera-su-compromiso-con-el-cumplimiento-del-acuerdo-de-paris>

Gutierrez Atoche, E. S. (2021). Análisis del impacto de la introducción de la generación distribuida en las redes de distribución eléctrica de la Unidad de Negocios Chiclayo-Electronorte SA de la Región de Lambayeque.

Herrera Galiano, R. (2021). Diseño y cálculo de una instalación solar fotovoltaica de 2, 3 MW y su conexión a la red de Media Tensión.

Mosqueira Llovera, A. D. (2021). Estudio para suministrar energía eléctrica mediante energía solar fotovoltaica a la institución educativa Rafael Loayza Guevara, Cajamarca interconectado a la red.

Parámetros solares y climatologías meteorológicas mensuales y anuales. Retrieved from: <https://power.larc.nasa.gov/data-access-viewer/>

Ramírez Castaño, S. 2004. *Redes de Distribución de Energía*. (3era. Ed.). Editorial Universidad Nacional de Colombia.

Reich, N. H., Alsema, E. A., Van Sark, W.G.J.H.M., & Nieuwlaar, E. 2007. “*CO2 Emissions of PV in the perspective of a renewable energy economy*”. 22nd European Photovoltaic Solar Energy Conference, Milan, Italy, pp. 3538-3542.

SEGOB, Diario Oficial de la Federación. 2020. ACUERDO por el que se emite la Política de Confiabilidad, Seguridad, Continuidad y Calidad en el Sistema Eléctrico Nacional. 15 May 2020. Retrieved from:

https://dof.gob.mx/nota_detalle.php?codigo=5593425&fecha=15/05/2020

Weber, B., Magaña-López, R., Martínez-Cienfuegos, I. G., Durán-García, M. D., & Stadlbauer, E.A. 2020. “*Current status of photovoltaic plants in Mexico – An analysis based on online monitoring*”. Energy for Sustainable Development. Volumen 57, Pages 48-56.

<https://doi.org/10.1016/j.esd.2020.05.003>

Instructions for Scientific, Technological and Innovation Publication

[Title in Times New Roman and Bold No. 14 in English and Spanish]

Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor

Institutional Affiliation of Author including Dependency (No.10 Times New Roman and Italic)

ID 1st author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st author: (Scholar-PNPC or SNI-CONACYT) (No.10 Times New Roman)

ID 1st coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st coauthor: (Scholar or SNI) (No.10 Times New Roman)

ID 2nd coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 2nd coauthor: (Scholar or SNI) (No.10 Times New Roman)

ID 3rd coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 3rd coauthor: (Scholar or SNI) (No.10 Times New Roman)

(Report Submission Date: Month, Day, and Year); Accepted (Insert date of Acceptance: Use Only ECORFAN)

Abstract (In English, 150-200 words)

Objectives
Methodology
Contribution

Keywords (In English)

Indicate 3 keywords in Times New Roman and Bold No. 10

Abstract (In Spanish, 150-200 words)

Objectives
Methodology
Contribution

Keywords (In Spanish)

Indicate 3 keywords in Times New Roman and Bold No. 10

Citation: Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor. Paper Title. ECORFAN Journal-Republic of Peru. Year 1-1: 1-11 [Times New Roman No.10]

* Correspondence to Author (example@example.org)

† Researcher contributing as first author.

Instructions for Scientific, Technological and Innovation Publication

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

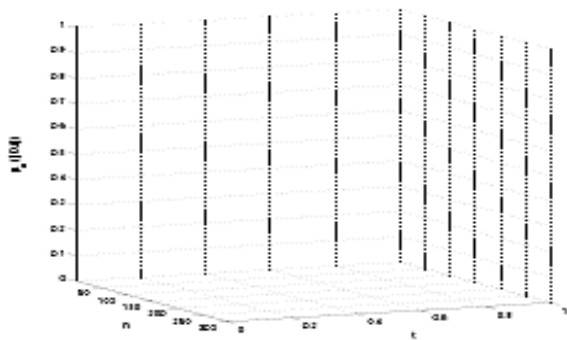
[Title No.12 in Times New Roman, single spaced and bold]

Products in development No.12 Times New Roman, single spaced.

Including graphs, figures and tables-Editable

In the article content any graphic, table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

[Indicating the title at the bottom with No.10 and Times New Roman Bold]



Graphic 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

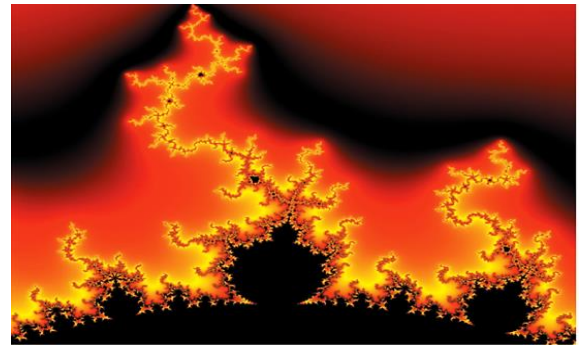


Figure 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

Table 1				

Table 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

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:

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

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 were funded by any institution, University or company.

Conclusions

Explain clearly the results and possibilities of improvement.

Instructions for Scientific, Technological and Innovation Publication

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.

Technical Specifications

Each article must submit your dates into a Word document (.docx):

Journal Name

Article title

Abstract

Keywords

Article sections, for example:

1. Introduction

2. Description of the method

3. Analysis from the regression demand curve

4. Results

5. Thanks

6. Conclusions

7. References

Author Name (s)

Email Correspondence to Author

References

Intellectual Property Requirements for editing:

-Authentic Signature in Color of Originality
Format Author and Coauthors

-Authentic Signature in Color of the Acceptance
Format of Author and Coauthors

Reservation to Editorial Policy

ECORFAN Journal Republic of Peru reserves the right to make editorial changes required to adapt the Articles to the Editorial Policy of the Journal. Once the Article is accepted in its final version, the Journal will send the author the proofs for review. ECORFAN® will only accept the correction of errata and errors or omissions arising from the editing process of the Journal, reserving in full the copyrights and content dissemination. No deletions, substitutions or additions that alter the formation of the Article will be accepted.

Code of Ethics - Good Practices and Declaration of Solution to Editorial Conflicts

Declaration of Originality and unpublished character of the Article, of Authors, on the obtaining of data and interpretation of results, Acknowledgments, Conflict of interests, Assignment of rights and Distribution.

The ECORFAN-Mexico, S.C Management claims to Authors of Articles that its content must be original, unpublished and of Scientific, Technological and Innovation content to be submitted for evaluation.

The Authors signing the Article must be the same that have contributed to its conception, realization and development, as well as obtaining the data, interpreting the results, drafting and reviewing it. The Corresponding Author of the proposed Article will request the form that follows.

Article title:

- The sending of an Article to ECORFAN Journal Republic of Peru emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Format of Originality for its Article, unless it is rejected by the Arbitration Committee, it may be withdrawn.
- None of the data presented in this article has been plagiarized or invented. The original data are clearly distinguished from those already published. And it is known of the test in PLAGSCAN if a level of plagiarism is detected Positive will not proceed to arbitrate.
- References are cited on which the information contained in the Article is based, as well as theories and data from other previously published Articles.
- The authors sign the Format of Authorization for their Article to be disseminated by means that ECORFAN-Mexico, S.C. In its Republic of Peru considers pertinent for disclosure and diffusion of its Article its Rights of Work.
- Consent has been obtained from those who have contributed unpublished data obtained through verbal or written communication, and such communication and Authorship are adequately identified.
- The Author and Co-Authors who sign this work have participated in its planning, design and execution, as well as in the interpretation of the results. They also critically reviewed the paper, approved its final version and agreed with its publication.
- No signature responsible for the work has been omitted and the criteria of Scientific Authorization are satisfied.
- The results of this Article have been interpreted objectively. Any results contrary to the point of view of those who sign are exposed and discussed in the Article.

Copyright and Access

The publication of this Article supposes the transfer of the copyright to ECORFAN-Mexico, SC in its Holding Republic of Peru for its ECORFAN Journal Republic of Peru, which reserves the right to distribute on the Web the published version of the Article and the making available of the Article in This format supposes for its Authors the fulfilment of what is established in the Law of Science and Technology of the United Mexican States, regarding the obligation to allow access to the results of Scientific Research.

Article Title:

Name and Surnames of the Contact Author and the Coauthors	Signature
1.	
2.	
3.	
4.	

Principles of Ethics and Declaration of Solution to Editorial Conflicts

Editor Responsibilities

The Publisher undertakes to guarantee the confidentiality of the evaluation process, it may not disclose to the Arbitrators the identity of the Authors, nor may it reveal the identity of the Arbitrators at any time.

The Editor assumes the responsibility to properly inform the Author of the stage of the editorial process in which the text is sent, as well as the resolutions of Double-Blind Review.

The Editor should evaluate manuscripts and their intellectual content without distinction of race, gender, sexual orientation, religious beliefs, ethnicity, nationality, or the political philosophy of the Authors.

The Editor and his editing team of ECORFAN® Holdings will not disclose any information about Articles submitted to anyone other than the corresponding Author.

The Editor should make fair and impartial decisions and ensure a fair Double-Blind Review.

Responsibilities of the Editorial Board

The description of the peer review processes is made known by the Editorial Board in order that the Authors know what the evaluation criteria are and will always be willing to justify any controversy in the evaluation process. In case of Plagiarism Detection to the Article the Committee notifies the Authors for Violation to the Right of Scientific, Technological and Innovation Authorization.

Responsibilities of the Arbitration Committee

The Arbitrators undertake to notify about any unethical conduct by the Authors and to indicate all the information that may be reason to reject the publication of the Articles. In addition, they must undertake to keep confidential information related to the Articles they evaluate.

Any manuscript received for your arbitration must be treated as confidential, should not be displayed or discussed with other experts, except with the permission of the Editor.

The Arbitrators must be conducted objectively, any personal criticism of the Author is inappropriate.

The Arbitrators must express their points of view with clarity and with valid arguments that contribute to the Scientific, Technological and Innovation of the Author.

The Arbitrators should not evaluate manuscripts in which they have conflicts of interest and have been notified to the Editor before submitting the Article for Double-Blind Review.

Responsibilities of the Authors

Authors must guarantee that their articles are the product of their original work and that the data has been obtained ethically.

Authors must ensure that they have not been previously published or that they are not considered in another serial publication.

Authors must strictly follow the rules for the publication of Defined Articles by the Editorial Board.

The authors have requested that the text in all its forms be an unethical editorial behavior and is unacceptable, consequently, any manuscript that incurs in plagiarism is eliminated and not considered for publication.

Authors should cite publications that have been influential in the nature of the Article submitted to arbitration.

Information services

Indexation - Bases and Repositories

LATINDEX (Scientific Journals of Latin America, Spain and Portugal)

RESEARCH GATE (Germany)

GOOGLE SCHOLAR (Citation indices-Google)

REDIB (Ibero-American Network of Innovation and Scientific Knowledge- CSIC)

MENDELEY (Bibliographic References Manager)

Publishing Services

Citation and Index Identification H

Management of Originality Format and Authorization

Testing Article with PLAGSCAN

Article Evaluation

Certificate of Double-Blind Review

Article Edition

Web layout

Indexing and Repository

Article Translation

Article Publication

Certificate of Article

Service Billing

Editorial Policy and Management

1047 La Raza Avenue -Santa Ana, Cusco-Peru. Phones: +52 1 55 6159 2296, +52 1 55 1260 0355, +52 1 55 6034 9181; Email: contact@ecorfan.org www.ecorfan.org

ECORFAN®

Chief Editor

SUYO-CRUZ, Gabriel. PhD

Executive Director

RAMOS-ESCAMILLA, María. PhD

Editorial Director

PERALTA-CASTRO, Enrique. MsC

Web Designer

ESCAMILLA-BOUCHAN, Imelda. PhD

Web Diagrammer

LUNA-SOTO, Vladimir. PhD

Editorial Assistant

TREJO-RAMOS, Iván. BsC

Translator

DÍAZ-OCAMPO, Javier. BsC

Philologist

RAMOS-ARANCIBIA, Alejandra. BsC

Advertising & Sponsorship

(ECORFAN® Republic of Peru), sponsorships@ecorfan.org

Site Licences

03-2010-032610094200-01-For printed material ,03-2010-031613323600-01-For Electronic material,03-2010-032610105200-01-For Photographic material,03-2010-032610115700-14-For the facts Compilation,04-2010-031613323600-01-For its Web page,19502-For the Iberoamerican and Caribbean Indexation,20-281 HB9-For its indexation in Latin-American in Social Sciences and Humanities,671-For its indexing in Electronic Scientific Journals Spanish and Latin-America,7045008-For its divulgation and edition in the Ministry of Education and Culture-Spain,25409-For its repository in the Biblioteca Universitaria-Madrid,16258-For its indexing in the Dialnet,20589-For its indexing in the edited Journals in the countries of Iberian-America and the Caribbean, 15048-For the international registration of Congress and Colloquiums. financingprograms@ecorfan.org

Management Offices

1047 La Raza Avenue -Santa Ana, Cusco-Peru.

ECORFAN Journal-Republic of Peru

“The strategic management to improve the competitiveness of fuel market companies”

ÁNGELES-GUZMÁN, Casandra, AGUILAR-MORALES, Norma and MAGAÑA-MEDINA, Deneb Elí

Universidad Juárez Autónoma de Tabasco

“Tourism area life cycle analysis in San Miguel de Allende Guanajuato”

SONDA-DE LA ROSA, Ricardo, RUIZ-LANUZA, Agustín and ALCUDIA-ROCHA, Josefina

Universidad del Caribe

Universidad de Guanajuato

“Standardization of the driver certification processes of the company Bebidas Mundial S. de R.L. de C.V.”

ROBLES-ARIAS, Isela Margarita, SO-FELIX, Stephany, ROSAS-ESTRADA, Kenya Patricia and VALDEZ-GUERRERO, Raquel

Instituto Tecnológico de la Paz

“Distributed generation with a photovoltaic generating plant interconnected to a medium voltage network in the marginalized town of Xbilincoc, Campeche”

LEZAMA-ZÁRRAGA, Francisco Román, CHAN-GONZALEZ, Jorge de Jesús, SHIH, Meng Yen and SALAZAR-UITZ, Ricardo Rubén

Universidad Autónoma de Campeche

