Journal of Business Development Strategies

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Journal of Business Development Strategies

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Presentation of the Content

In Issue 17 is presented an article *Generating strategies with KPIs (Key Performance Indicators) through the use of TIC's (Information and Communication Technologies),* by CASTORENA-PEÑA, Jesús Abraham, SILVA-AVILA, Alicia Elena, GONZÁLEZ BENÍTEZ, Rubén Álvaro and MARTÍNEZ CASTRO, Jehú Efraín, with adscription at Universidad Autónoma de Coahuila and Universidad Veracruzana, in the next article *Territory, vulnerability and sustainability in the coastal-tourist strip of Acapulco bay*, by NIÑO-CASTILLO, Isaías Naú, NIÑO-GUTIÉRREZ, Naú Silverio, NIÑO-CASTILLO, Jacob Elías and ROJAS-COPA, Aline Estrella, with adscription at Universidad Autónoma de Guerrero, in the next section *Tourism organization, planning and management of the auxiliary locality of San Baltazar Campeche, Puebla, Mexico*, by PEREA-BALBUENA, José Ángel, CARRASCO-ROMERO, Víctor Josaphat, ZAMORA-FERNANDEZ, María de los Dolores and PÉREZ-DÍAZ, Rodolfo Noé, with adscription at Benemérita Universidad Autónoma de Puebla, in the next section *Waiting lines model to streamline customer service*, by MÁRQUEZ-MONÁRREZ, Olivia, AGUIRRE-OROZCO, Mario Abelardo, DELGADO-MARTÍNEZ, Martha Lilia and CONTRERAS-MARTÍNEZ, Jesús José, with adscription at Instituto Tecnológico de Delicias.

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Generating strategies with KPIs (Key Performance Indicators) through the use of TIC's (Information and Communication Technologies)

Generando estrategias con KPI's (Indicadores Clave de desempeño) mediante el uso de TIC's (Tecnologías de Información y Comunicaciones)

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Abstract

Organizations are facing an uncertain scenario due to business dynamics and the evolution of their technical terminology to adapt to new ways of competing in the environment, which requires assertive indicators to ensure permanence and success in the medium and long term of any company. Through the use of KPIs, organizations have the opportunity to analyze and monitor relevant information from their company to make the operations of a company's sales area more efficient. The objective of this study is to propose a set of key performance indicators (KPI's) that allow the performance of a company dedicated to the activity of commercialization and manufacture and import of cleaning products to be measured, which is analyzed using the monetary variables of units or percentages. For the development of the investigation, Microsoft SQL Server was used as technological tools for the creation of the data model, and for the design, construction and analysis of the KPIs, the BSC Designer tool was used.

KPI´s, PyMES, SQL Server, BSC Designer

Resumen

Las organizaciones se encuentran ante un panorama poco incierto debido a la dinámica de los negocios y a la evolución de su terminología técnica para adaptarse a las nuevas formas de competir en el entorno, el cual amerita de indicadores asertivos para asegurar la permanencia y éxito a mediano y largo plazo de cualquier compañía. Mediante el uso de KPI's las organizaciones tienen la oportunidad de analizar y monitorear información relevante de su compañía para hacer más eficientes las operaciones del área de ventas de una empresa. El objetivo del presente estudio es proponer de manifiesto un conjunto de indicadores claves de desempeño (KPI's) que permita medir el rendimiento de una empresa dedicada a la actividad de comercialización y fabricación e importación de productos de limpieza, la cual es analizada mediante las variables monetaria de unidades o porcentajes. Para el desarrollo de la investigación se utilizó como herramientas tecnológicas Microsoft SQL Server para la creación del modelo de datos, y para el diseño, construcción y análisis de los KPI's se utilizó la herramienta BSC Designer.

KPI´s, PyMES, SQL Server, BSC Designer

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† Researcher contributing first author.

Introducction

Currently, organizations affected by a series of challenges due to the changes determined by the environment and the emergence of new rivals, that is why companies need to continuously and quickly adapt their business strategies in such a way that they can optimize your processes to stay competitive and grow favorably in the markets. For which, they must generate the necessary mechanisms to fulfill the goals set by the organization, which implies the definition, design and structuring of a series of indicators that allow the evaluation of the fundamental aspects to achieve the success of the companies. In this line Sánchez (2003), finds that in micro and small and medium-sized enterprises (SMEs) there are no objectives (strategy, vision and objectives), strategies, action plans and performance indicators that allow successful achievement. of their strategies.

For this reason, the relevant result that is within micro-enterprises and SMEs will be the implementation of key performance indicators (KPIs), since they are a measurement tool that offers a series of advantages, to focus management efforts. on key areas of performance and quantify compliance with the strategic objectives established by the organization, among others.

KPIs provide a quick and condensed overview of a company's actual and objective performance, as well as enabling continuous control, communication, and improvement of its processes (Bassen & Kovács, 2008). These measures also represent an essential management tool because they are used to quantify important data based on the performance and performance of organizations (Casas, 2015).

Having a measurement system expands opportunities for evaluating past and present performance, as well as thinking about future strategies that can strengthen the company's organizational and professional growth (Madroñal, Galeano and Escobar, 2016).

According to Rodríguez, Alfaro and Ortiz (2009), a performance measurement system allows managed companies to make decisions based on strategies, due to information on whether or not the established objectives are being achieved. For Velimirovića, Velimirovićb and Stankovića, (2011) KPIs represent financial and non-financial measures that organizations have to monitor how successful they were in achieving their stated objectives. To constitute an effective performance measurement system, it is very important to have defined and standardized all the processes within the organization, since this will depend on its successful implementation. Also, according to Ferry, Murphy, Zakaria and Zakaria (2015) argue that the implementation of KPIs needs strong support, both human and non-human, for their introduction to be effective within organizations.

KPIs have become a crucial support tool for organizations today, because through these indicators companies have the opportunity to effectively identify, monitor and measure the performance of their processes. However, there is still an absence of this type of indicator within certain industrial sectors, such is the case of the commercialization, manufacturing and import sector of cleaning products. For this reason, the following research is presented, which aims to propose a set of key performance indicators (KPIs) for the sales process of SMEs in the sector of commercialization, manufacture and import of cleaning products, in order to provide assertive information and evaluate the effectiveness of the sales process leading to the fulfillment of the organization's strategic objectives.

Methodology

For the development of this study, we had access to a company dedicated to the activity of commercialization, manufacture and import of cleaning products. For this, information was requested regarding its mission, vision, strategic objectives and information on its main activities, focusing solely on the company's sales area. Once the information was obtained, an analysis of the sales process was carried out to define, design and structure the main performance indicators that would control and monitor the performance of said area.

Construction and implementation of the data model for the generation of KPI's

Modeling and building the sales process, we proceeded to load the data into the created database, which was designed using the ascending modeling strategy, this model consists of starting with a list of all the attributes of the data model , the requirements are decomposed, independently conceptualized and finally merged into a global scheme (Garrido, 2014). Resulting in the final model (Figure 1) which will house the transformed data from the previous stage for the analysis and extraction of the KPI's.
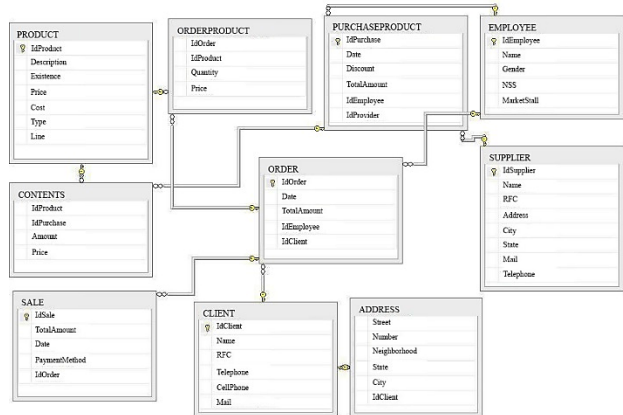
Figure 1 Data model of the sales process
Source: own elaboration

Definition and Construction of KPI's

The construction of the KPI's was developed to establish the main performance indicators that would allow a diagnosis and monitoring of the activities and sales processes of the company, in such a way that this would serve as support for the creation and design of a table of integral command in the future. For the construction of the KPIs, the BSC Designer Software was used, which is a business performance management system that focuses on the Balanced Scorecar concept, allowing the creation and monitoring of KPIs, strategic maps and reports (Maya, 2016). It also offers the possibility of making a quick analysis of the indicators and forecasting the behavior of their values in a certain time, keeping the company informed about the most important changes in their KPIs. Next, the design and the values obtained using the technological tool are shown (Figure 2).
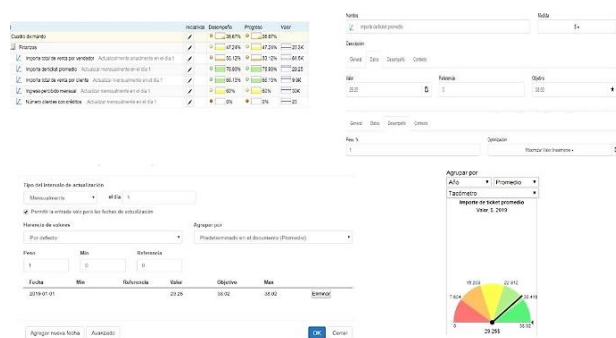
Figure 2 Construction of the KPI "Average ticket amount"
Source: own elaboration

Results

The results obtained are presented below, which correspond to a set of key performance indicators (KPI's) to monitor and measure the performance of the sales process of the company in question. The indicators designed are based on the strategic objectives of the company and the exploitation of the sales process database.

To drive the increase in the amount of sales within the company, three KPIs were defined which will be able to generate profitability and market value for the company over time.

- Total amount of sale per seller. This indicator represents the total sold per employee within the company. Which was considered, because the company does not have a balance in the sellers' client portfolio (Graph 1). Likewise, we propose to balance this portfolio by setting biweekly sales goals.
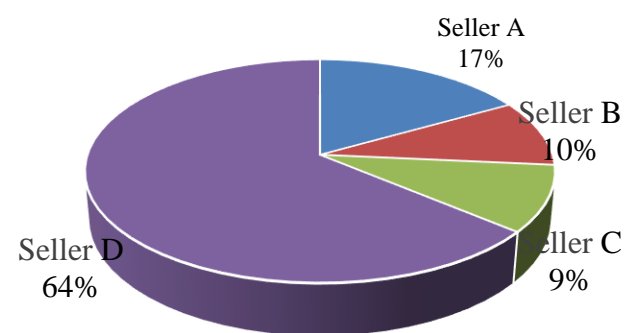
Graphic 1 Total sales per seller
Source: own elaboration

- Average ticket amount. The following measurement is obtained based on the number of transactions made from retail and wholesale sales (Graphic 2). So it is relevant to take advantage of the 2577 retail visits and establish sales work strategies to increase them.
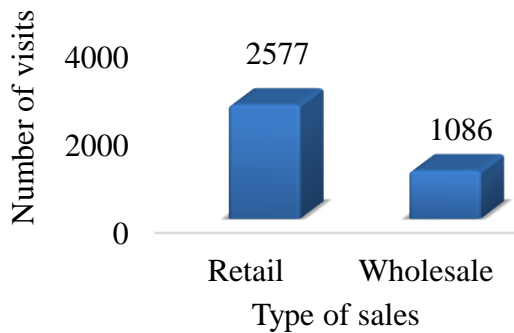
Graphic 2 Number of customers by retail and wholesale
Source: own elaboration

- Total sales amount per potential customer. This represents the total consumed by customers who are characterized by not making frequent purchases in the company and who are likely to become potential customers who can increase their purchases.

Client	Total ($)
Client A	10918.07
Client B	9065.42
Client C	10447.64
Client D	9252.92

Table 1 Total sale amount between $ 8500 and $ 11000 per potential customer
Source: own elaboration

Regarding the company's liquidity increase, only one key performance indicator was defined:

- Monthly income. This measurement represents the total sold per month. Which will identify those months that are below the average of total sales ($ 50,000) and thus, be able to generate sales strategies in those months for their increase and that the company does not lack cash flow.
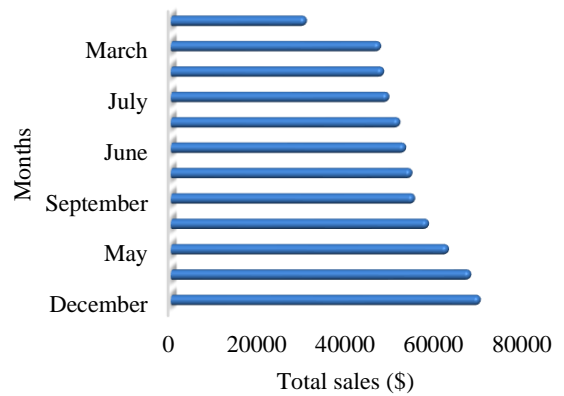
Graphic 3 Total monthly sales
Source: own elaboration

While, to increase the value of the brand, which refers to the products manufactured by the company, it is proposed to measure the total number of products sold by each type of product. For which the following KPI was defined:

- Number of products manufactured. This indicator represents the total number of products manufactured by the company sold, with the purpose of promoting the increase in sales of manufactured products with respect to marketing and import products (Graphic 4).
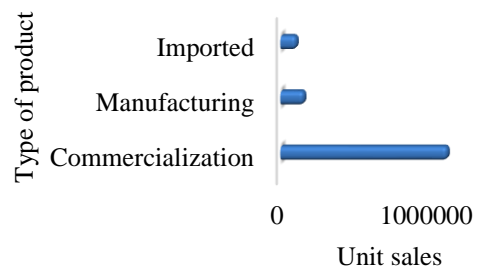
Graphic 4 Total sold by product type
Source: own elaboration

On the other hand, to increase the presence of the company in different states of the Mexican Republic, the following indicator is proposed:

- **Number of potential states.** This measure represents the number of states in which the company has a presence in the Mexican Republic (Table 2).

Total states
15

Table 2 Number of states with presence in the Mexican Republic
Source: own elaboration

And finally, to increase alliances with new suppliers that allow a secure supply and constant flow of products, the following indicator was established:

- **Number of items sold.** This measurement indicates the total number of best-selling items in the company.
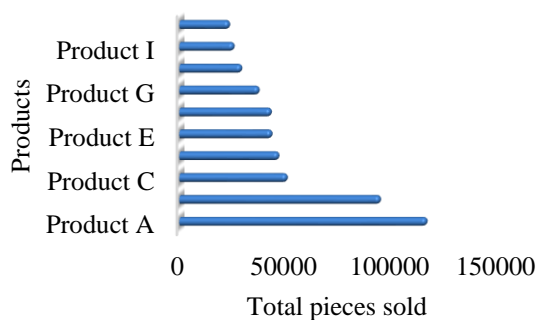
Graphic 5 Top 10 best-selling products
Source: own elaboration

Conclusions

A company is a system with organized or related parts or elements that interact with each other to reach the same objective. And to achieve this, it is essential to have a series of key performance indicators that allow you to evaluate and review the fulfillment of the organization's strategic objectives, so that you can review the current performance of your sales processes and think about future strategies in if so required. Likewise, it is relevant to have a trustworthy structured database system that supports KPIs for their correct monitoring and behavior, as well as facilitating the visualization and analysis of relevant data to determine objectives that drive the organizational and personal growth of SMEs in the commercialization, manufacturing and import sector of cleaning products.

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Territory, vulnerability and sustainability in the coastal-tourist strip of Acapulco bay

Territorio, vulnerabilidad y sustentabilidad en la franja costera-turística de la bahía de Acapulco

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Abstract

The objective was to synthesize the vulnerability of the coastal-tourist strip of Icacos beach in Acapulco, Guerrero, Mexico to the phenomenon of the sea in the background. The methodology used was documentary developed during 2019 and complemented with fieldwork between January-August 2020, which included the application of 750 questionnaires of 14 items to national and foreign tourists, tourism service providers and residents. The results achieved were: 1) promote early warning of the swell phenomenon in order to safeguard human lives, 2) contribute to the reduction of economic losses in hotel infrastructure (fixed and mobile) and 3) promote resilience between tourist service providers and residents. The conclusions were: a) the swell will be a recurring hydrometeorological phenomenon, b) tourism service providers are committed to preserving the Blue Flag distinctive and c) establishment of a greater link between the authorities of the municipal-state branch, the service providers, residents and academics. The contribution is the proposal of a risk traffic light in order to contribute to decision-making in favor of human life and local territorial development.

Urban development, Tourism, Vulnerability

Resumen

El objetivo fue sintetizar la vulnerabilidad de la franja costera-turística de la playa Icacos de Acapulco, Guerrero, México ante el fenómeno mar de fondo. La metodología empleada fue documental desarrollada durante el año 2019 y complementada con trabajo de campo entre enero-agosto del 2020, el cual comprendió aplicación de 750 cuestionarios de 14 ítems a turistas nacionales y extranjeros, prestadores de servicios turísticos y residentes. Los resultados logrados fueron: 1) promover una alerta temprana ante el fenómeno de mar de fondo a fin de salvaguardar vidas humanas, 2) contribuir a la disminución de pérdidas económicas en la infraestructura hotelera (fija y móvil) y 3) fomentar la resiliencia entre los prestadores de servicios turísticos y residentes. Las conclusiones fueron: a) el mar de fondo será un fenómeno hidrometeorológico recurrente, b) los prestadores de servicios turísticos apuestan a conservar el distintivo Blue Flag y c) establecimiento de una mayor vinculación entre las autoridades del ramo municipal-estatal, los prestadores de servicios, residentes y académicos. La contribución es la propuesta de un semáforo de riesgo a fin de contribuir a la toma de decisiones en favor de la vida humana y el desarrollo territorial local.

Desarrollo urbano, Turismo, Vulnerabilidad

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Introduction

The discussion about the vulnerability that is materialized in hydro-meteorological disasters, as well as their impacts on society, is a topic that is addressed from two perspectives. On the one hand, research carried out in the field of exact sciences is oriented towards the increase in the incidence of natural phenomena with destructive potential for society. On the other hand, research within the social sciences is more focused on studying how extreme phenomena impact society and how society responds or adapts to the alterations generated by natural and anthropogenic disasters. The contributions in both fields of research mentioned above underline that natural and anthropogenic disasters reveal a chained series of processes that reflect the complexity of factors that intervene in them (Rodríguez, 2007).

From the tourist point of view, the dynamics observed between such activity and the occurrence of the disturbing phenomenon under study were addressed, in addition to the parallel use of the geographic method, where a fundamental postulate of the discipline was started, that of meaning, demonstrating that the real mechanisms in the decision making of individuals are more complex than those considered by conventional geography. From the territorial part, the work is simultaneously a bet on the need to study this novel phenomenon for the inhabitants, tourists and providers of tourist services.

The main objective of the trial was to synthesize the relationship between territory, vulnerability and sustainability in the coastal-tourist strip in Acapulco Bay. The guiding question was: What is the vulnerability of the coastal-tourist territory of Acapulco Bay to the hydrometeorological phenomenon known as sea bottom?

This study is justified because the sea floor in the Pacific Ocean is present from 2012 to the present (2020) and therefore its analysis, implications and particular consequences in the bay of Acapulco are of great importance. In this sense, this essay aims to contribute with updated information that will serve as an input for tourists, municipal decision makers, hotel businessmen and civil organizations that are linked to this problem.

At present, knowledge of the deep sea and its impacts on coastal areas has been widely documented at the international level by Casas-Prat and Sierra (2010 and 2012) in the case of the Spanish Costa Brava. Due to their geographical location, the Mexican Pacific coastal areas are threatened by the current climate variability, due to the increase in sea level, as well as the increase in the number and intensity of hydro-meteorological phenomena.

There are also several international organizations that study, explain and propose specific solutions to various coastal sites, where international, national, state or regional conferences are held, as well as the formation of academic networks to promote resilience in local territories, contribute to the reduction of vulnerability and, as far as possible, evidence of sustainability (Sorrentino, Portugal, Pazos & Vázquez, 2020).

This represents an important advance for these regions, as they are home to highly productive ecosystems, as well as significant human settlements. It is estimated that nearly 50% of the world's population lives in a coastal strip, especially between 0 and 10 meters of altitude (Narvaez, 2018). Therefore, it is a priority to develop transdisciplinary research with themes around vulnerability, adaptation and resilience to meet the new challenges posed by climate variability in coastal areas.

This shows that coastal areas are vulnerable to hydrometeorological events and human activities. It is understood then that vulnerability to climate diversity is the result of dynamic and complex social and environmental interrelations on multiple temporal and spatial scales. These trends encourage the adoption of prevention strategies for possible impacts and associated risks in accordance with the particular phenomenon and the region (Miller, 2007).

International studies sponsored by the United Nations Environment Programme (UNEP) and the University of the Pacific Research Center (CIUP) seek to promote the care of coastal ecosystems such as the Amazon, which comprises a fragile global ecosystem in "the countries of Bolivia, Brazil, Colomba, Ecuador, Peru, Guyana, Suriname, and Venezuela" (Rios, 2020: 22).

NIÑO-CASTILLO, Isaías Naú, NIÑO-GUTIÉRREZ, Naú Silverio, NIÑO-CASTILLO, Jacob Elías and ROJAS-COPA, Aline Estrella. Territory, vulnerability and sustainability in the coastal-tourist strip of Acapulco bay. Journal of Business Development Strategies. 2020

In Mexico, vulnerability in coastal areas is evident due to the high concentration of population in sites very close to marine waters in addition to the fact that in the last 20 years there have been significant economic, social and environmental changes in these geographical enclaves, a coastal example in the Gulf of Mexico is Holbox, Quintana Roo (Medina-Palafox, 2020).

This dynamic is also present in the Mexican Pacific where this phenomenon has been documented by Rosey (2016) who explains that in the bay of Acapulco from the months of March to November of each year this hydro-meteorological phenomenon is presented which brings with it economic losses in the area of restaurants, in the infrastructure of the parianes that are located in the vicinity of the beach area, as well as the accumulation of sand in the pool area of the hotel El Cano.

Added to the economic issue is the social topic, where the presence of the sea in the background affects the recreation and enjoyment of domestic and foreign tourists and thus their experience in this beach destination is less satisfactory because there are restrictions on access to the sea and the rental of jet skis, sailing, parachute, diving and others.

There is a notorious contradiction between the economic development of the coastal strips supported by the impulse of the tourist activity, while the repercussions that this brings towards the elements of nature are overlooked: water, soil, vegetation and biological diversity. History has shown that the affectations, transformations or changes in the use of natural land, in terms of its vocation in coastal areas occupied by tourism, is one of the problems that are not taken into account when planning this activity.

Due to the above, risk and vulnerability are two constants in the course of human life, on the one hand, and on the other, economic losses in hotel establishments, which is why some tourist developments question the maintenance of tourist activity in the future (Babinger, 2012).

In the south of Mexico, where Guerrero is located and with it the coastal-tourist strip under study. The geographical location of Icacos beach is 16°50'15" to 16°51'15" North Latitude and 99°50'45' to 99°52'30" West Longitude with respect to the Greenwich Meridian. It is located in the southeastern part of the bay, which according to its municipal zoning for tourist purposes is known as "Acapulco Dorado" (Figure 1).
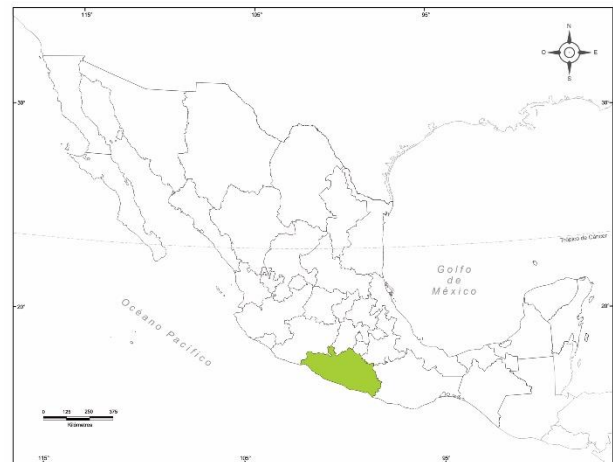
Figure 1 Geographic location of Guerrero
Source: Niño, 2014

In this essay, the correlation between the coastal-tourist territory and the vulnerability and risk in the presence of a sea bed was sought. In order to evidence the impacts that this phenomenon brings on the population settled in the vicinity, tourists and service providers by presenting suspensions in the development of productive activities, due to changes in sea conditions, resulting in a decrease in income of families involved in the tourist industry, Narvaez (2018).

Because of this, the phenomenon known as "Mar de Fondo" is defined as a long and continuous wave generated by storms at sea, sometimes these storms originate near Australia, so the phenomenon travels distances of 10 thousand kilometers to the Mexican coast moving along the Pacific Ocean. It can occur all year round, but with greater recurrence from May to November. Some of the effects are a reduction in the beach area, dragging of real estate near the sea, damage to infrastructure, commerce, roads and people (CENAPRED, 2016).

Regarding the physical and chemical factors corresponding to the seawater present in the tourist area of Icacos beach, there must be 35 parts per thousand of sodium chloride, a concentration of nutrients, gas and acidity of seawater according to the National Water Commission (Conagua, 2018a), also indicates that this recreational area meets the necessary requirements of safe environments for intensive recreation in marine waters.

The monitoring of the quality, sanitation and research of seawater is essential for different secretariats related to health and tourism, for which in 2003 the National Commission for the Prevention of Disasters (Cofepris) developed the Guidelines to Determine the Quality of Seawater for Recreational Use in order to prevent health risks to the bathing population.

According to international guidelines, fecal enterococci were selected as an indicator of water quality for primary contact recreational use. In the first instance, 500NMP/100 was set as the permitted limit, but in 2010, it was reduced to 200, for the systematization and standardization of monitoring on Mexico's beaches by the National Water Information System (SINA) as well as federal support programs with the same purpose for municipalities (Conagua, 2018b).

The sustainability of the marine ecosystem is beneficial because the waves travel in all directions which allows the mixing of phytoplankton and even a process of energy change takes place, which benefits the fauna so that it can access diverse marine flora.

There is great diversity of marine species in the area of influence of Icacos, due to the high number of fish of the continental platform of the central Pacific, in their majority they belong to the confluence of Panamerican fauna, of the Californian region and Gulf of California. Icacos beach, in particular, is located in a transition zone from the California currents and the southern equatorial countercurrent (Palacios, 2002, p. 47).

The sea bed has great scenic value due to its scenic capacity where colorful fish are observed, which has favored the use of its waters through various intensive recreational and fishing tourism activities. The local marine currents cause cold water to emerge during March, visibility reaches 20 meters deep, plankton reproduces itself, while in summer the water temperature rises which nullifies the visibility of the sea bed as a result of earth materials transported during summer rains.

Methodology

The research shown here is of a mixed nature, as it combines the quantitative and qualitative, not experimental but explanatory, which was supported by data and official sources of information disclosed by different government corporations, at different levels, such as federal, state and municipal.

The methodological sequence applied during the study was planned in an integral way, in correspondence with the one developed in the sociogeographic-risk studies, a novel perspective that is currently being developed in Latin America to understand the characteristics of the territory, society and environment.

In the period provided for this research, 750 questionnaires were applied between August and December 2019, to tourists (national and foreign), providers of tourist services (tenants, waiters and formal and informal vendors), as well as local residents. In order to know the degree of information available to each of these sectors involved, about the high tide phenomenon.

The selection of the universe of study, in its spatial and temporal scopes, arose from the existence of a problem whose complexity demands a holistic and integrating vision of the social, economic and environmental elements, which led to the selection of the methodology of the sociogeographic and risk studies. With regard to the characteristics of the analysis method used in this research, two can be summarized, which served as a fundamental basis for the sociogeographic and risk study on the subject of the sea in the background on Icacos beach.

1) The first aspect of the method used was the descriptive-explanatory character of the sea in the background on Icacos beach, which is considered as the first leverage of the necessary geographical knowledge of the area under study, the location and description of the determined space or territory. In such a way that the physical space or elements of nature are first described, and in a later phase the elements are explained in an interrelated way, their influence in the social and economic life of the sea in the background in the society of Acapulco or residents, providers of tourist services, as well as tourists.

The physical elements of the sea-land interface facilitate its description and understanding since the changes that occur there are slower than in the dynamics of social transformations. On a human time scale, biogeochemical cycles are long while social processes are relatively short and their interpretation tends to be complex, so the descriptive level is exceeded.

2) Another aspect associated with the method used is its holistic nature. The importance of a totalizing method lies in explaining the social, economic and environmental components in an interrelated way to fully explain the system. It is considered necessary in the analysis of the bottom sea in the Icacos beach because such aspects, in some way or another, affect the conformation of this last one; in such a way that the multiple interactions that exist between the whole and its parts are disaggregated, reason why an aspect of the bottom sea in the coastal-tourist strip of Acapulco cannot be analyzed independently of the regional system within which it is inserted; at the same time the regional system is only understood when the diverse aspects that integrate it in their interrelations and space-time evolution are analyzed.

The method that we have sought to implement by carrying out the local systemic analysis of the background sea in Icacos beach, contains the four basic principles of the geographic sciences: the first characteristic of the outlined method correlates with the principles of localization and distribution; the historical aspect and dialectical conception with the principle of causality and the holistic meaning with the principle of relationship (Tamayo, 1990).

The method on which this research is based was deductive in nature, that is, it started from the general to the particular. It is an explanatory and even transversal study, where secondary printed-digital sources were reviewed and analyzed, in the office work; in the application of questionnaires and primary information sources obtained in the field work, thanks to participant observation, direct observation and case studies (Babbie, 2000), in order to have a complete picture.

Analysis phase: it refers to the geographical recognition of the study area in its vertical and horizontal structures. The vertical includes the organization and information hierarchy of natural elements of the area; it distinguishes, characterizes and classifies in a cartographic way the differentiating elements (relief, geology and climate), which in turn act on water, soil and biota to influence their dynamics and distribution patterns; it includes the human factor (demography, human settlements, land uses, productive activities, development plans and programs), which intervene in the natural environment (Niño, 2014, p. 25).

The horizontal structure is the time-space arrangement, which shows the current reality in Icacos, evidencing similarities and differences that define the overall functioning of the study area (Ibid., p. 22).

To explain these structures, the techniques of the questionnaire, participant observation and cartography were used. The first corresponds to defining the number of interviewees, was determined by the formula of finite population to be used in the different sectors of the population that is relevant for the investigation, the sample is a numerical part that represents a whole population and since this study is based on the quantitative and qualitative approach as it has been manifested in the methodological framework, it was important to apply the questionnaire in order to determine the sample of tourists, residents and Tourist Service Providers (PST) who enjoy Icacos beach so that the results obtained can be representative of the total population that travels during the vacations of the year.

A sample is understood to be a part or subset of the population of tourists, residents and PSTs, selected for the purpose of obtaining representative information on a given phenomenon in order to generate measurements or observations (Porras, 2017). To calculate the sample it was indispensable to use a mathematical formula for finite populations which is shown below:

Formula

Finite or known population: $n = Z^2 p*q\ N\ /\ e^2\ (N-1) + Z^2 p*q$

Where:

n= Sample size (to be determined).

N= Population or universe (tourists, residents and average daily PST).

Z= Confidence level (95%=level 2.24).

p= Probability in favor (0.5).

q= Probability against (-0.5 no answer).

e= Sampling error (5%).

This finite population formula was used for the resident sector based on the population density per square kilometer in the municipality of Acapulco, which is 469. 3 (CIJ-EBCO, 2018), this amount was first rounded to the lower whole number for practical purposes and then multiplied by two, which are the linear kilometers of the area under study, after that, it was divided by four to obtain an approximate number of inhabitants that can be in the 250 meters between the coast line and the Avenida Costera Miguel Aleman, which resulted in 235 inhabitants, finally proceeded to replace the values of the equation mentioned above, to obtain as an objective sample the completion of 147 questionnaires for this segment.

It is worth mentioning that the population density of the port of Acapulco contrasts with that of the state, which is 56 inhabitants per square kilometer (INEGI, 2015b). In addition, the floating and seasonal population, such as tourists, must be added to the above, where the service providers have an average schooling of 7.3 years (ICTEM, 2012). In the municipality of Acapulco, there is no census of the number of tourist service providers, so a similar process was followed in applying the formula for infinite or unknown populations, where the result was 218.

In the case of tourists, the formula of finite populations was used, since although there is an approximate state count of over 13 million by 2018 (Castro, 2018), it is not known how many visit Icacos beach, Therefore, it was necessary to infer the number of visitors to the area under study by using the average total tourist arrivals from 1992 to 2018 (DATATUR, 2019), which yielded the number of 3,798,034 and then substitute the values in the equation, which resulted in the need to conduct 385 questionnaires for the target population.

In summary, the techniques on which this study was based were foreseen from the beginning in the following points:

- Documentary research; desk work or research was supported on topics such as: risks, vulnerability, disasters, resilience; in addition, information was collected on economic, political, geographic, social and cultural aspects of the municipality of Acapulco.

- Laboratory work; which consisted of analyzing the samples collected in situ of the elements water and sand.

- Cartography; supported by the search for existing cartography available in different public and governmental institutions to represent the area of study at a detailed scale.

- Participatory observation; consists of taking photographs and notes on the perception of the people interviewed.

- Field work; visits to the study area to collect information and samples in order to enrich the research, both quantitative and qualitative techniques were applied.

Regarding the laboratory work, first group of techniques, a water and sand sampling was carried out in the area of interest in June 2019, these samples were subjected to reactive and laboratory tests to determine physical-chemical elements present in sea water, such as pH, dissolved oxygen, salinity, as well as temperature; regarding the collected sand, chemicals were applied to see if they contained contaminants and heavy materials by dragging or transported from the continent.

On collecting the samples, one was contained in a one liter container of high density polyethylene, which was washed for three times with sea water (in situ), then the bottle was introduced at an estimated ten centimeters from the surface of the water in the breaker near the shore, for this purpose the bottle was arranged horizontally so that the greatest amount of water was introduced without resistance, even moving against the current. Once the samples were collected, they were placed in two iceboxes, to which ice was added, in order to maintain the approximate temperature of 4°C until they entered the Clinical Analysis Laboratory of the UAGro, south zone established in Acapulco.

Results

Geographic knowledge is an important pillar for the theoretical and practical construction, understanding the territory as the container of inseparable links between human beings and their environment, where an infinite number of activities closely related to the spatial distribution of these and their geographic particularities of the built and natural environment take place (Niño, Adame & Niño, 2017).

The threats impact on the environment, the population and the different economic activities in the coastal areas, which makes it necessary to study the coastal dynamics, in order to determine those adaptation measures to climate change that reduce vulnerability.

It is important to emphasize that coastal destinations concentrate the world's tourist offer, which reflects the effects of territorial transformation and reorganization. These geographical enclaves constitute the most common and differential form of tourist development and the main reason for the displacement with the greatest international tourist flow (Benseny, 2006).

Therefore, the tourist activity is closely linked to the demand of the coastal space, a fact that should be highlighted by its incidence in the different environments, both physical and social, in this specific case of study corresponds to a tourist model of sun and beach. This gives a tourist panorama of a demand that grew without planning, consuming too much space, which sometimes reports serious consequences for the natural environment and landscape.

Acapulco specialized in mass tourism. However, new motivational trends in demand are looking for places where leisure is combined with a clean, unsaturated and scenically pleasant environment. This implies that tourism demands receiving destinations, which have a better territorial and environmental management, more sustainable and care, for which it is essential in the planning of the activities that are developed through an urban policy with a clear and defined vision in the territory to achieve tourism excellence and not lose market share.

NIÑO-CASTILLO, Isaías Naú, NIÑO-GUTIÉRREZ, Naú Silverio, NIÑO-CASTILLO, Jacob Elías and ROJAS-COPA, Aline Estrella. Territory, vulnerability and sustainability in the coastal-tourist strip of Acapulco bay. Journal of Business Development Strategies. 2020

Therefore, the coastal space is a very dynamic area, where there is a strong interrelationship between terrestrial and marine ecosystems (Niño, Huerta & Valdivia, 2017).

For this tourist process, the visitor relates aspects prior to his visit, among whose attributes are: a) geographical location, b) extension, c) conformation, d) quality of its coastal areas, e) "benign" climate and f) costs. This means that, since its beginning, Acapulco has specialized as a destination for mass tourism, although the sun and beach scheme is still positioned as the most demanded (Ferradás, 2009), it has to adapt to the climatic variability.

It is important to prioritize the implementation of security schemes for visitors who enjoy the city. During the vacation season between July 10 and August 19, 2018, 769,860 tourists arrived at the port of Acapulco. With the above, the average hotel occupancy was 65 percent, which means that seven out of every 10 rooms were occupied during the vacation. This situation left an economic income of three thousand 110 million pesos (Novedades Acapulco, 2018a); that year there was also an increase in international tourism from 85 different countries (Novedades Acapulco, 2018b). Once the desk and field work was completed, and even complemented with the application of questionnaires, the following results were obtained:

- The dynamics of the sea in the background began in the Bay of Acapulco on August 12, 2012, which caused astonishment among the tourists who were enjoying the beach on that date. This phenomenon made national news as it was the first time it was present in the state of Guerrero.

- In 2013, it occurred twice in the months of August and October. As a consequence, this phenomenon brought with it the dragging and accumulation of sand in the hotel El Cano and its pool areas, the restaurant "La Playita" in the hotel Calinda was also affected. This resulted in the need for managers and workers of these hotels to rent equipment to clean the affected areas.

- One year later, in 2014, fifteen events were presented, ranging from April to September. On the one hand, it was clear that this coastal phenomenon will be recurrent in the coming years, which will bring positive effects to the marine environment since it causes an exchange of energy and matter, beneficial for the marine flora and fauna. On the other hand, the negative effects will be observed from the coastal strip towards the hotel zone in the direction of Avenida Costera Miguel Alemán.

- In the year 2015, there were records of eighteen events at sea in the background according to the Port Captain's Office, the Secretary of the Navy, local news and the press. Concerned about the local socioeconomic and environmental effects, those who have begun an incipient behavioral education of tourists in the face of the phenomenon of the sea in the background, in order to lessen the economic impacts on hotel infrastructure and avoid human losses as much as possible.

- Then, in 2016, there was an increase to twenty-five events, from March to November. This phenomenon over time has resulted from the interest of residents, tourists, service providers and the Municipal Government. Thus, they have called on national and foreign tourists who enjoy this and other beaches in the bay of Acapulco, to take into account the recommendations issued by civil protection, port captain and the Secretariat of the Navy.

- For the year 2017, there were a total of thirty events between February and October, where the months with the most events registered were February, July and August. The affected hoteliers requested economic support from the federal and state governments through the National Fund for Disasters (FONDEN). They were supported with a bag of five million Mexican pesos that were distributed among the providers of tourist services that were affected.

- The year 2018 presented an increase of 43% with respect to the previous year and, therefore, the number of affected tourists increased in such a way that there were records of five deaths according to the local press. Regarding the effects on the hotel infrastructure, they decreased thanks to the preventive and corrective measures taken.

- As far as 2019 is concerned, there were fifty events per deep-sea between February and August, with the highest incidence in May with 52% of the total events.

Finally, from 2012 to November 2020 there have been more than 180 deep-sea events, which suggests that this phenomenon will continue to increase. With the purpose of avoiding its catastrophic effects, it is advisable to continue studying this phenomenon in order to propose concrete options to evidence the relationship between the territory, vulnerability and sustainability for tourism purposes.

Discussion

Geographic knowledge is an important pillar for theoretical and practical construction, as it understands the territory as the container of inseparable links between human beings and their environment, where an infinite number of activities closely related to the spatial distribution of these and their geographic particularities of the built and natural environment take place. Threats impact on the environment, the population and the different economic activities in coastal areas, which makes it necessary to study the coastal dynamics, in order to determine those measures of adaptation to climate change that reduce vulnerability, thanks to the Objectives of Sustainable Development (ODS), which aim to achieve local sustainability in a cross-cutting and integrated manner (Cantar, Endere & Zulaica, 2020).

It is important to highlight that coastal destinations concentrate the world's tourist offer, which reflect effects of transformation and territorial reorganization. These geographic enclaves constitute the most common and differential form of tourist development and the main reason for the displacement with the greatest international tourist flow (Benseny, 2006). Therefore, tourist activity is closely linked to the demand of the coastal space, a fact that should be highlighted due to its incidence in the different environments, both physical and social, in this specific case of study it corresponds to a sun and beach tourist model. This gives a tourist panorama of a demand that grew without planning, consuming too much space, which sometimes reports serious consequences for the natural environment and landscape.

Acapulco specialized in mass tourism. However, new motivational trends in demand are looking for places where leisure is combined with a clean, unsaturated and scenically pleasant environment. This implies that tourism demands receiving destinations, which have a better territorial and environmental management, more sustainable and care, for which it is essential in the planning of the activities that are developed through an urban policy with a clear and defined vision in the territory to achieve tourism excellence and not lose market share. Therefore, the coastal space is a very dynamic area, where there is a strong interrelationship between terrestrial and marine ecosystems.

For this tourist process, the visitor relates aspects previous to his visit, among whose attributes are: a) geographical situation, b) extension, c) conformation, d) quality of its coastal areas, e) "benign" climate and f) costs. This means that, since its beginning, Acapulco has specialized as a destination for mass tourism since the seventies, although the sun and beach scheme is still positioned as the most demanded one (Ferradás, 2009), it has to adapt to the climatic variability.

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- With respect to 2019, there are fifty events per sea between February and August. May is the month with 52% of the total events.

Finally, to date there have been more than 180 deep-sea events, which suggests that this phenomenon will continue to increase. In order to avoid its catastrophic effects, it is advisable to continue studying this phenomenon in order to propose concrete options for the care of the environment, society and economy for tourism purposes. For this purpose, it is important to take into consideration the psychological dimension of sustainability in each of the elements of nature in order to promote behaviors that allow the achievement of sustainable social development (Heredia, Falconí; Barreto, Amores, Jamil & Torres, 2020).

Acknowledgements

Conclusions

In response to the guiding research question, what is the vulnerability of the coastal tourist area of Acapulco Bay to the hydrometeorological phenomenon known as the sea floor? The answer is that there is a close relationship between vulnerability and sustainability, including social, economic and political-cultural factors, as well as ecological factors in the coastal-tourist strip of the Bay of Acapulco, particularly in relation to the Icacos beach.

With reference to the objective of synthesizing the existing relationship between the territory, vulnerability and sustainability in the coastal-tourist strip in the bay of Acapulco.

-      From the social point of view, it involves the native population and even the most dispossessed and marginalized rural population who, under such conditions, are the ones who try to insert themselves in the jobs of the tourist branch to obtain some benefit that contributes to guarantee the family's food.

-      From the economic and ecological aspects, the presence of the sea in the background affects the same existing natural resources that, together with the labor force, constitute the only reproducible heritage in Acapulco. When considering both aspects, the problem of high waves in the study area is not independent of other problems.

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Tourism organization, planning and management of the auxiliary locality of San Baltazar Campeche, Puebla, Mexico

Ordenación, planificación y gestión turística de la junta auxiliar de San Baltazar Campeche, Puebla, México

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Abstract

Puebla is one of the municipalities with the greatest wealth in cultural manifestations in Mexico, due to the historical process that begins from the period of the conquest. It is the holder of a historical center, Cultural Heritage of Humanity, which has allowed it to hold international events that attract national and foreign visitors. From the tourist point of view, tourism for meetings, congresses, conventions, fairs and exhibitions has been a guiding principle of this activity. The city of Puebla has 17 auxiliary locality that converge in its neighboring territory, some of these localities are already inserted in the urban area of the city, such is the case of San Baltazar Campeche, this locality was established in its beginnings as an indigenous people; Today it is an urban area with important commercial, social, educational and leisure infrastructure. Therefore, it is necessary to develop a Tourism Organization, Planning and Management Plan that allows it to generate social management actions in order to incorporate said territory into the tourist-economic dynamics of the city. Thus, allowing the generation of jobs, better living conditions for its inhabitants and an adequate urban development of this area, which was rural at the beginning and which today encompasses an urban territory of great dynamism for the development of the city.

Auxiliary Locality, Culture, Tourist Attractions, Tourist Management

Resumen

Puebla es uno de los municipios con mayor riqueza en manifestaciones culturales de México, debido al proceso histórico que se inicia desde el periodo de la conquista. Es poseedor de un centro histórico Patrimonio Cultural de la Humanidad, lo que le ha permitido la realización de eventos internacionales que atraen a visitantes nacionales y extranjeros. Desde el punto de vista turístico, el turismo de reuniones, congresos, convenciones, ferias y exposiciones ha sido un eje rector de esta actividad. La ciudad de Puebla es poseedor de 17 juntas auxiliares que convergen en su territorio aledaño, algunas de estas localidades se encuentran insertadas ya en la mancha urbana de la ciudad, tal es el caso de San Baltazar Campeche, esta localidad en sus inicios fue establecida como un pueblo indígena; en la actualidad es un área urbana poseedor de importante infraestructura comercial, social, educativa y de ocio. Por lo que es necesario desarrollar un Plan de Ordenación, Planificación y Gestión Turística que le permita generar acciones de gestión social a fin de incorporar dicho territorio en la dinámica turistica-económica de la ciudad. Permitiendo así generar empleos, mejores condiciones de vida de sus habitantes y un adecuado desarrollo urbano de esta área que en un principio fue rural y que hoy en día abraca un territorio urbano de gran dinamismo para el desarrollo de la ciudad.

Junta auxiliar, Cultura, Atractivos Turísticos, Gestión Turística

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Introducción

Starting from the fact that the territory is heterogeneous, the diverse actors and agents put forward a proposal to intervene in the auxiliary boards of Puebla to motivate tourist activity and let tourism be a pretext to guide public policies for integral development. The objective is to carry out a tourism feasibility study to evaluate its potential.

The project that is presented in the auxiliary locality of San Baltazar Campeche in the city of Puebla, Mexico has as its main objective "To lay the foundations to be able to generate an organization, planning of resources and attractions that may be susceptible to tourist use and this way through adequate political management to be able to incorporate them into the general dynamics of the city of Puebla, Mexico.

The city of Puebla, specifically the historic center, has been developing through a dynamic of cultural-heritage tourism, business and meeting tourism, which require other types of strategies in terms of tourism development and promotion.

In this way, this study will present alternatives in order to incorporate this auxiliary territory which is already framed in the municipal urban dynamics as a support for tourist activities that can be amalgamated to the general tourist dynamics.

Justification

The Municipal Development Plan of the Municipality of Puebla, 2018 -2021 is made up of five thematic axes and 26 programs that structure its operation. In program 1 entitled Right to social welfare with inclusion and equity, it mentions the following:

"Our social policy, as well as the programs and actions that emanate from it, seek to improve the material base necessary for the lives of citizens who have the least: better homes, healthy eating, decent schools and public spaces. But they are also designed to create scenarios that enhance people's capacities and guarantee access to social rights through the reconstruction of the social fabric, collaborative work, recognition of indigenous peoples; prevention of violence against women; care of girls and boys of the municipality and the inclusion of diversity. (City Hall of the Municipality of Puebla, 2019, page 19)

The social welfare proposed in the program is built considering the opinion of the social actors that converge in the territory, it is for this reason that it prioritizes citizen participation as a guiding axis:

"Citizen participation is fundamental to achieve a collaboration scheme between society and the government, for this reason it is a priority to establish mechanisms that allow the connection and citizen interest in public issues and actions. The lack of participatory democracy mechanisms causes the lack of interest of citizens in the public decision-making process, which ultimately leads to unilateral government actions. In this sense, the current challenge involves promoting citizen participation to contribute to improving living conditions through programs that prioritize attention to community needs identified in a participatory manner by the inhabitants of the municipal territory. " (Puebla City Council, 2019, page 21)

The dynamics of tourism requires the operation of a whole system with coordinated elements in order to have quality of travel for the visitor and quality of life for the inhabitant. In program 13 of said plan it states that:

"To be competitive with the different destinations in Mexico, constant innovation in the offer of tourist products is necessary, in order to position the values and attractions of the city above other travel options […] For this reason, it was necessary the renewal of the promotion strategies of the capital with the intention of spreading activities, encouraging the use of the infrastructure of the capital and generating, consequently, the economic development of its citizens "(Puebla City Council, 2019, p. . 259)

Aligned with the strategies outlined above, it is proposed to carry out a feasibility study for tourism in the auxiliary locality of San Baltazar Campeche, a territory that has been absorbed by the growth of the urban area of the city and is currently presented as if it were a spacious neighborhood, as it has been transformed by the dynamics of modernity. In this auxiliary board, according to the INEGI's 2010 Population and Housing Census, there is a population of 22.19%, which is equivalent to 341,640 inhabitants.

This project will make it possible to involve said auxiliary board in the dynamics of municipal tourism, to be included in the development and promotion plans that this agency has been carrying out, which may generate the strengthening of a sociocultural dynamic that allows its inhabitants and neighborhoods to they make up participating in the cross-cutting and unifying activities that tourism carries out and which by its very nature becomes a functional-structural activity.

Theoretical framework

There are two main reasons for the founding of the city of Puebla; the first had to do with the distribution of the encomiendas of the territory of New Spain among the first colonizers who participated in the company and thus found new cities. Another reason was the reason that, since there was no city where travelers and merchants could rest and provide themselves with what they needed on their way from Veracruz to Mexico City or vice versa, it was thought to found an intermediate city.

In this way, on April 16, 1531, the first mass was celebrated and later the first trace of the primitive city was carried out. Despite the setbacks that occurred, 50 houses were established with the same number of Spaniards and approximately one thousand Indians dedicating themselves to livestock, agriculture and commerce, thus founding the city of Puebla.

For its construction, indigenous labor was used from nearby towns such as Tlaxcala, Huejotzingo, Tepeaca and San Francisco Totimihuacan, among others; These builders settled in spaces designated for them according to their place of belonging on the outskirts of the original layout, giving rise to the neighborhoods of nearby Indians and towns.

San Baltazar Campeche was a settlement that emerged at the same time as the founding of the city of Puebla, having settled in it a group of Tlaxcalans, who were in charge of building the houses and collective works, for which they were allowed to live in the hill called Xilotzingo (place of tender corn) same that adjoined a place called Huexotitla, place of Huexotles or sauces. Don Martín Pérez, who was given the nickname of partidor, was in charge of distributing lots, this character founded in the year 1537 a wheat mill that he called "San Baltazar Huexotitla", in honor of one of the wise men, for be Pérez very believer in this devotion.

In the plan of the city of the year 1698, the territorial jurisdiction of San Baltazar Campeche appears very delimited, said town was isolated for a long time since it had as its limits the San Francisco river and the bridges that connected with the city, which were made of materials very fragile, so they constantly crumbled; It was until 1905 that Mr. Jesús García built an iron one, on July 9, 1937, the municipal president Dr. Sergio Guzmán built a masonry one at the intersection of Avenida 16 de Septiembre and 47 Poniente - Oriente, which allowed easy transit of its settlers.

On September 6, 1962, the XLI legislature of the H. Congress of the State of Puebla decreed that the territorial jurisdiction of the town of San Baltazar Campeche will become part of the municipality of Puebla with the name of Auxiliary Board, with the city of Puebla as a limit, the municipality of San Andrés Cholula and the auxiliary boards of Ignacio Romero Vargas, Ignacio Zaragoza, San Francisco Totimehuacan.

In 1964, one of the most important hydraulic works in the city in tubing of the San Francisco River was concluded, this work allowed to amalgamate the territories of the city with that of San Baltazar Campeche, eliminating the natural limit that the river created, this allowed it to be rapidly populated and divided, absorbing the urban area to said auxiliary locality.
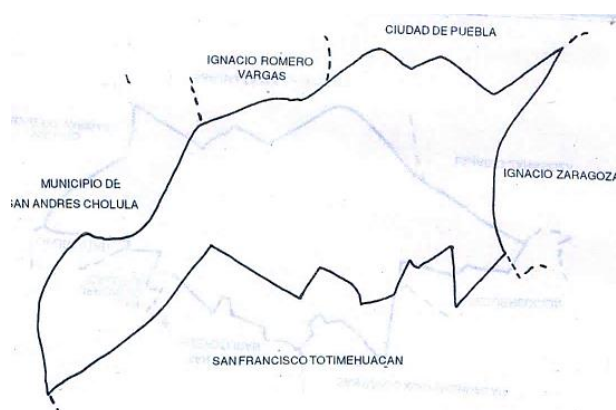
Map 1. Geographic limits of the auxiliary locality
Source: Obtained from Carrillo, 1993

The territorial limits are the San Manuel subdivision (east), the Anzures subdivision and Las Salle sports fields (north), the las palmas subdivision (west) and the Bugambilias subdivisions (south).

The locality has its linguistic origin in the name of the San Baltazar Huexotitla mill and in the name of one of the chiefs of the place known as "Campeche", a name of Mayan origin, which is composed of the radicals Kan, serpent, "which means fertility and wisdom and peche "Tick", so it is equivalent to "Snake that bites like a tick" or "Small snake".

Ordination

Tourism has been conceptualized almost from its beginnings as an element of territorial displacement for leisure purposes, this is motivated by the existence of natural and cultural resources and services in order to carry out recreational activities.

Said resources are anchored to a land or territory and are usually put in value to motivate tourist activity, as well as use and enjoyment of the local population.

In this way, the attractions become attributes of the places, giving the territory its own identity; In this way, an interesting link is established between tourism and development, since to a large extent the existence of attractions is a generator of strategies for territorial development.

According to the European Charter for Spatial Planning (1983, as I quote Millán, 2009) it is understood as "the spatial expression of the economic, social, cultural and ecological policies of society" (p.3). For its part, within the Mexican regulations, in the General Law of Human Settlement, Territorial Ordering and Human Development, in its article 2, fraction XXVI defines it as:

XXVI. Territorial Planning of Human Settlements: territorial planning is a public policy that aims to occupy and rationally use the territory as a spatial basis for socioeconomic development strategies and environmental preservation. (Chamber of Deputies of the Honorable Congress of the Union, 2016)

Population

According to the data provided by the National Institute of Statistics and Geography (INEGI) in the Population and Housing census (2010) and in the National Housing Inventory (2016) provided by the Municipal Planning Institute (IMPLAN), the population of the Auxiliary Board of San Baltazar Campeche (JASBC) has shown a constant demographic growth in recent years, increasing in 2016 by 0.92% (14,233 inhabitants) compared to 2010.

POPULATION GROWTH OF THE AUXILIARY
BOARD OF SAN BALTAZAR CAMPECHE,
2010-2016

	San Baltazar Campeche
Población (2010)	341,640
Población (2016)	355,873
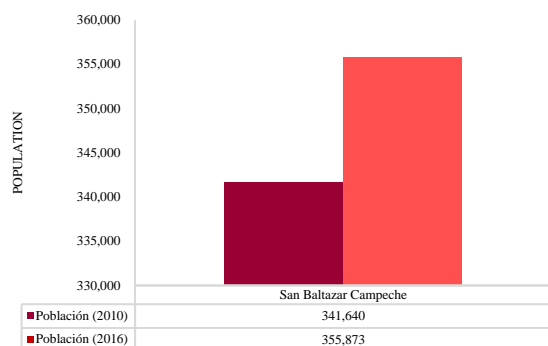
Graphic 1 Population growth of the Auxiliary Board of San Baltazar Campeche 2010-2016
Source: own elaboration based on INEGI, Population and Housing (2010) and the National Housing Inventory (2016)

The proximity of the Auxiliary Locality with the urban area has allowed it to permeate the growth and transformations of the urban-demographic design of the city of Puebla, vanishing in some way, its geographical borders with the city.

Currently the auxiliary locality of San Baltazar Campeche has 145 neighborhoods and five neighborhoods: El Reloj, Tepalcatillo, San Francisco, La barranca, La Coyotera and La Cruz. And like almost all towns it has its municipal presidency, the cemetery, school and market. Flores and López (1993) mention that by 1989 the territory was divided into the following categories of dwellings, 48% were private subdivisions, 38% were communal settlements and 14% were publicly promoted (which included the ejidos of San Pablo Xochimehuacan, San Andrés Cholula, among others).

Tourist resources

Natural heritage

Considering the conurbation process of the San Baltazar Campeche Auxiliary Locality, it is necessary to mention that the environment in the first instance is characterized by being urban, natural spaces such as the Laguna de San Baltazar Campeche, the Juárez Park, the Botanical Garden and Herbarium of the Benemérita Autonomous University of Puebla (BUAP) and the Laguna de Chapulco Centennial Park are the natural spaces that this territory has.

The San Baltazar lagoon is the best known and most popular attraction of the auxiliary board, it has an area of 13.81 hectares, covering 50% by the body of water. According to the 2008 research, the possibility of developing activities related to the sighting of 36 regional and migratory bird species is mentioned, with a higher concentration in the months of September to December (Almazán-Núñez & Hinterholzer-Rodríguez, 2010). It should be noted that among the lake activities that can be carried out is the walk and use of boats. The lake has not been used in the tourist offer of the municipality of Puebla, therefore, the daily users are the residents of the place and inhabitants of the city.

The Botanical and Herbarium Garden of the BUAP, is one of the university spaces with the greatest importance in the Auxiliary Board, here the research on environmental conservation converges and the interaction on the part of the university community and the population in general.

The university botanical garden currently has ten sections of regional plants, divided considering geographical, ecological, taxonomic and use criteria.

The herbarium collection serves as a botanical bank that exceeds 37,000 specimens of species, mostly from the State of Puebla, thus generating a wide collection of municipalities (BUAP, 2019).

The Laguna de Chapulco Centennial Park, located in the southwest of the City of Puebla, in contact with primary metropolitan roads (Av. 14 Sur and Periférico Ecológico), immersed in a highly varied urban context of popular housing complexes, developments informal, middle class subdivisions, public and private schools (Arquitectura Panamericana.com, 2017).

In the Laguna de Chapulco Centennial Park it is constituted, you can carry out various activities on its islands and viewpoints, also having an Environmental Education Center (CEA), Community Center (CC), gym, cycle track, jogging track and solar farm.

Parque Juárez, this park resulting from the urban restructuring of the area, located on the Héroes 5 de Mayo boulevard (in front of the Plaza Dorada shopping area) with an area of 45,000 m2, has more than a thousand trees, an artificial lake, a jog track, a cycle track, courts, cafeteria.

Cultural heritage

The cultural resources that a group possesses are characterized by being the direct representation of the distinctive elements that make up the culture of human groups, regardless of their extension, for this reason, heritage is part of social construction, this refers to Because the objects themselves do not become heritage, it is until the moment that the individuals of the community attribute meanings, usefulness and significance according to the social and historical moment that these are considered as such. (Pérez R., s.f., p. 12).

UNESCO defines the cultural heritage of a people as:

> "The works of its artists, architects, musicians, writers and scholars, as well as the anonymous creations, arising from the popular soul, and the set of values that give meaning to life, that is, the material and non-material works that express the creativity of that town; language, rites, beliefs, historical places and monuments, literature, works of art, and archives and libraries" (Pérez R., s.f., p. 22).

The cultural identity of the auxiliary locality of San Baltazar Campeche materializes through the celebration on January 6 dedicated to the Patron Saint "San Baltazar", the Huehues Carnival and its local gastronomy; It should be noted that national celebrations are also held, such as the September 16, on November 20, the day of the dead, to name a few examples.

In the Auxiliary board it acquires it name in honour of one of the Magi of the Catholic tradition "San Baltazar" this celebration takes place on January 6 and 7 in the parish in his dedication. It should be noted that an essential element of the celebration is the "Dance of the twelve pairs of France or of the Moors and Christians" this celebration dates from the Viceregal era, it is an adaptation of the dance with European motifs that alludes to the struggle of Christians against the French kings this holiday also represents the battle of Carlo Magno against the Philistines.

Markets are a fundamental piece in the transmission of cultural knowledge, gastronomy concentrates a large part of the symbolic contents of a human group, it is through this that worldviews, narratives and communion with the geographical environment that frames the community materialize. population. Man materializes his environment through his dishes and tastes popular knowledge and the land.

In this place, traditional dishes of the Puebla cuisine are sold such as: mole poblano, green pipián, chiles en nogada, chalupas, cemitas and various snacks.

Travel services

The supply of services that make it possible for resources to be consumed and commercialized by tourist demand can be grouped into accommodation, food and beverage establishments, shops, transportation, and leisure and recreation equipment; the adaptation of these justifies, in most of its occasions, a real estate and urban transformation, and consequently a transformative impact on its territory of a range that depends on the tourist specialization of the place.

The economic vocation of the auxiliary board of San Baltazar Campeche is focused mainly on the secondary and tertiary sector, the latter standing out with 16 503 economic units, followed by 1603 from the secondary sector, therefore, it can be seen that the proximity to the city de Puebla has led to the development of the industrial, commercial and service sectors.

The offer of tourist services identified by the Municipal Planning Institute (2019) is mainly concentrated by food and beverage establishments with 88.2%, lodging establishments with 9.1%, recreation spaces with 1.6% and others (Plaza Dorada and Crystal) 1.1%.

Type of service	Total economic units
Food and drinks	164
Lodging establishments	17
Recreation	3
Others	2
Total	186

Table 1. Type of tourist services
Source: Own elaboration based on IMPLAN 2019

Characterization of economic activities

The economic vocation of the territory that has been transformed over time, for the year 1972, the population that inhabited this space was 48,914 people, of which 9.96 percent (4,876 people) were dedicated to agriculture, compared to other auxiliary locality, the economy was sustained in the secondary sector (production), this due to the fact that the inhabitants provided their labor in factories located within the auxiliary board or in neighboring places, carrying out manufacturing, masonry, carpentry, to mention some examples (Vázquez L., 1973).

Product of the conurbation that exists in San Baltazar Campeche has triggered the use of usable land for agricultural activity to be used to create living spaces and shops to meet the demands of the urban area. Therefore, the economic vocation is focused mainly on the secondary and tertiary sector, the latter standing out with 16,503 economic units, followed by 1,603 from the secondary sector, therefore, the proximity with the city of Puebla has caused the development of the industrial, commercial and service sectors.

Planning

The planning of the territory is an important tool to be able to guarantee the integral functioning of the space and that in its practice it becomes the vehicle for the optimization of the benefits that its implementation generates economic dynamics.

When the territorial and urban planning of a tourist space is carried out in the tourist activity, it is materialized through management actions in order to be able to apply rationality criteria and principles of sustainability in the territorial context in which the tourist dynamics are immersed.

Vera et al (2013) propose that the correct intervention of the territory must contemplate the various social, political and economic actors that coexist in the space, for this it takes up the contributions of Vera Rebollo and Anton Clavé, 1996; Ivars, 2003) to propose the lines of action:

- The complete conviction of the conceptual robustness of the proposals to be implemented and of the possibilities derived from their development.

- Acceptance of limits for the activity to be developed in order to avoid irreversible impacts.

- The definition of the levels and types of impacts: environmental, economic and socially acceptable in the development process;

- The definition of the basic elements of the structure of the territory and the configuration of a frame of reference for the actions of the different public and private administrations.

Everything is because the territory is a complex system in which different actors and influences interact, so it is necessary that planning interventions must be faced with numerous elements and components in order to have a tourism planning process integrating all components of the system.

In short, basic resources, infrastructures, services, promotion and the demand itself that will be the central axis of said system, complemented by management and governance between authorities, companies, and local society to generate an integrative and systemic approach.

Management

Tourist spaces are a set of ecological values, such as landscape, cultural, social and recreational, these fulfil different functions, firstly concerning their own nature, they also obey productive spaces and are arranged in recreational and tourist uses; That is why the need to be able to access an adequate management of them using specific planning instruments provided for in the different legislations (federal, state and municipal), thus future tourist activities must comply with these regulations.

The management of tourist activity in these spaces and territories must be an active part of the strategies for the protection and conservation of resources and must respect the regulations of tourist use and the rules that will be developed in the development plans.

The enhancement of resources and their structuring in order to create tourist products, allows their valorisation and ensures in a rational way their contribution to tourist activity, generating a socioeconomic development in these spaces and their areas of influence, having a special care in the quality, conservation and criteria to be considered in the proposal of future tourist activities.

Among the actions to be proposed, those based on the knowledge, interpretation and enjoyment of the natural and cultural values of the resources will be privileged. It is important to favor initiatives aimed at creating experiences that induce responsible behaviour by tourists.

In the planning and management of tourist activities, the participation of all tourist agents and local population is of vital importance, in order that all actors can meet the expectations of the project, also supporting their strategies for a better sustainable development of the tourism.

Public-private cooperation in the local context is decisive in order to ensure success in the actions.

Proposal

Based on the territorial analysis of the auxiliary board of San Baltazar Campeche, it is proposed to integrate the natural and cultural resources and services of the space, in order to be able to articulate them to the existing tourism system in the municipality through the following proposals:

1.- Natural resources:

Laguna San Baltazar

In collaboration with the Faculty of Biology of the Benemérita Universidad Autónoma de Puebla (BUAP) to generate a program for the rehabilitation and maintenance of the ecosystem of the lagoon in order to favor the reception of species of birds (regional and migratory) throughout the year, encouraging nature tourism in space.

BUAP Herbarium and Botanical Garden

In coordination with the Ministry of Tourism of the Municipality, guided visits will be promoted on weekends considering the load capacity of the space, likewise, it will seek to generate collaboration ties with other public agencies to promote environmental education in the local population.

Laguna de Chapulco Centennial Park

In this space, the programs offered by the Environmental Education Center (CEA) and Community Center (CU) will be promoted in the local population, as well as outdoor sports activities.

Juarez Park

In collaboration with the students of the BA in Biology at BUAP, a phytological and dendrological intervention program will be proposed, favoring regional species.

Considering the above, it is proposed to integrate a route of natural spaces.

2.- Cultural resources:

In coordination with the ecclesiastical authorities, social and religious associations, the Municipal Institute of Cultural Arts of the municipality and the Municipal Tourism Secretariat, it is intended to formulate a program of cultural activities highlighting the patronal feast of January 6 dedicated to San Baltazar seeking ordination market vendors of stalls and rides to ensure safety for local people and visitors.

Likewise, in the celebrations of the Carnival festivities, it is proposed to consolidate the presence of the Huehues gangs, seeking support for traditional clothing, its insertion and promotion in the Huehues Festival organized by the Municipality of Puebla City Council.
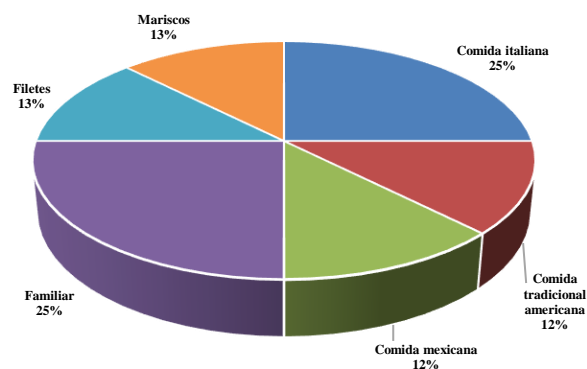
Gastronomy

One of the main reasons for visiting the city of Puebla is the regional gastronomy, being considered one of the most important in the country. This auxiliary board has a local market with various stalls that sell regional dishes prepared by traditional cooks and cooks, which preserve ancestral techniques and knowledge, so that the diner can have the security of tasting dishes from original recipes.

A significant number of gastronomic establishments (38) that offer various cuisines and culinary specialties are concentrated on Avenida 43 poniente, and there are also typical restaurants of Puebla cuisine.

It is proposed to be able to consolidate this avenue as a gastronomic path so that the local population and visitors can taste the gastronomic offer throughout the year, also promoting tourist menus and seasonal dishes; in collaboration with the students of the Bachelor's Degree in Gastronomy and the Bachelor's Degree in Tourism Administration from Benemérita Autonomous University of Puebla, a gastronomic festival will be held in May with the theme "Wheat: ancestral food."

Gastronomic offer in Av. 43 poniente.

Graphic 1 Gastronomic offer of the corridor of 43 west
Source: Self made

3.- Tourist services

Sport centers

There are 2 centers mainly highlighting the BUAP infrastructure with the following spaces: High Performance Center, the Arena, Convention Center, Los Lobos Stadium and the Benito Juárez High School Sports Center; and the Alpha 2 Club.

With the support of the Municipal Institute of Sports of the Municipality, the students of the degree of Physical Culture of the BUAP plan to take advantage of the recreational infrastructure in order to generate high-impact sporting events that promote physical activity in the local population and the displacement of visitors in sports seasons.

Malls

Taking into account that there are two shopping malls: Plaza Cristal and Plaza Dorada, it is proposed in coordination with the National Chamber of Commerce (CONACO) and the Secretary of Tourism of the Municipality to implement a discount portfolio that is distributed in the hotels of the city, mainly among visitors who come to the city for the purpose of attending a congress or convention.

Conclusions

One of the preferences of tourism is the visit to easily recognizable spaces in the cities, created specifically to satisfy the needs and consumption of the populations, constituted as places of dynamic activity because they have infrastructure, buildings and recreational and sports equipment and cultures of different densities and qualities; These places can be considered as the result of a characteristic urbanization structure of the place, which is socially and symbolically distinctive from the population.

The growing diversity and plurality of contemporary culture has meant that conventional tourist centers are not necessarily the only places of significant symbolic creation of the local population and therefore, a place for tourism recreation.

From this new perspective, it can be affirmed that the inclusion of neighboring territories to traditional tourist centers with due planning and comprehensive management may be incorporated into new tourist dynamics; Such is the case of the Auxiliary locality of San Baltazar Campeche that as it has been analyzed, having been a labor provider town, it has now been established as an important commercial area within the urban area of the city of Puebla, with important tourist elements that can be detonators of a new way of doing tourism, which can also be used by the local population to enjoy their free time and leisure.

This territorial demarcation must have adequate tourism management, led by the local tourism authorities and dynamically incorporating the different actors of the place through a participatory and inclusive governance scheme aimed at achieving equal opportunities and social promotion. that seeks to ensure conditions of well-being for all.

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Article

Waiting lines model to streamline customer service

Modelo de líneas de espera para eficientizar la atención al cliente

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Abstract

The main objective of this research is to identify and analyze the waiting line behavior of a gas station in Delicias City, located in Chihuahua State; by performing a sample and statistical analysis in order to determine the customer's behavior while waiting in line, and by applying the waiting line system or queuing theory to determine the timing and efficiency of customer service and to detect the potential improvement opportunities. The queuing theory does not directly solve the problem, nevertheless it contributes to generate important information required to anticipate some waiting line characteristics, for instance, the average waiting time, customer service timing, customer's duration in the system, and the efficiency of the line. As a result, it can be established a balance between the number of servers and the number of customers of the gas station, which helps to define the correct strategy so that the found problems are solved.

Waiting line, Statistical analysis, Service efficiency

Resumen

La presente investigación tiene como objetivo principal, identificar y analizar el comportamiento que presentan las líneas de espera de los clientes de una estación de gasolina en Cd. Delicias, Chih., para lo cual se realizó un análisis estadístico que clarifica el comportamiento de los mismos en la estación de servicio y se aplicó posteriormente la metodología de líneas de espera o teoría de colas en el sistema, con ello se determinó la eficiencia del servicio al cliente y las potenciales oportunidades de mejora. La teoría de colas en si no resuelve directamente el problema, pero contribuye con la información vital que se requiere para tomar las decisiones concernientes prediciendo algunas características sobre la línea de espera, tales como el tiempo de espera promedio del cliente, la duración del cliente en el sistema y la eficiencia de la línea. Como resultado, se puede encontrar el equilibrio entre el número de servidores y los clientes que acuden al establecimiento, lo que ayuda a establecer la estrategia correcta para dar solución a los problemas detectados.

Líneas de espera, Análisis estadístico, Eficiencia de servicio

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Introduction

A waiting line is when one or more customers wait for service. The customers can be people or objects, such as machines waiting for maintenance, sales orders waiting to be processed or shipped, or materials in inventory waiting to be used. Waiting lines are formed due to a temporary imbalance between the demand for service and the capacity of the system to provide the service.

The waiting line generation, produces different types of complications, which are reflected whether in a short or medium term. Therefore, Hiller (2010) says there is a set of mathematical models that are framed in the "Queuing Theory". These models look to finding balance between the number of units waiting in line and the amount of serves that supply the service demand.

The research was carried out in a gas station located in Delicias City, a town of Chihuahua State. The main objective of this project is to study the waiting lines of the gas station, conducting to offer a clear vision to take decisions, as well as to know how efficient if the actual company's system.

Literature Review

Queuing Theory

The waiting line analysis is of special interest to company's managers, because it affects decisions regarding design, capacity planning, space distribution, etc.

According to Krajewski (2008):

A waiting line is when one or more customers wait for service. The customers can be people or objects, such as machines waiting for maintenance, sales orders waiting to be processed or shipped, or materials in inventory waiting to be used. Waiting lines are formed due to a temporary imbalance between the demand for service and the capacity of the system to provide the service.

Queues (waiting lines) are part of daily routine. Everybody waits in lines to buy a movie ticket, make a bank deposit, pay on the supermarket, send a package by mail, obtain food in a cafeteria, go up to a fair game, etc.

The time that a country's population losses in waiting line is an important factor in both, their life quality and their economy efficiency.

In addition, there are great inefficiencies due to other types of waiting, besides than people in line. For instance, when machines are waiting to be repaired can occur production losses. Vehicles (even ships and trucks), that must wait their download can delay subsequent deliveries. Airplanes that wait to takeoff or land can disorganize the posterior program of flights.

The delays in telecommunications broadcasting due to line saturation can cause unexpected failures in data. When manufacturing jobs are waiting its process, the production process can be fractured. The delay of service jobs according to its delivery date is a cause of future deals losses.

According Hiller and Lieberman (2010) the queuing theory is the study of waiting in all these various guises. It uses queueing models to represent the various types of queueing systems (systems that involve queues of some kind) that arise in practice. Formulas for each model indicate how the corresponding queueing system should perform, including the average amount of waiting that will occur, under a variety of circumstances.

Therefore, these queueing models are very helpful for determining how to operate a queueing system in the most effective way. Providing too much service capacity to operate the system involves excessive costs. But not providing enough service capacity results in excessive waiting and all its unfortunate consequences. The models enable finding an appropriate balance between the cost of service and the amount of waiting.

Mathur (1996) enlisted the characteristics for a waiting line, as follows:

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A customer's population, which is the set of all possible customers.

An arrival process, which is the form of the customer's population arrival.

A queuing process, which is formed by the way customers wait to be attended, and a queuing discipline which is the way customers are chose to be provided with the service.

A leaving process, which has two types:

Elements that completely abandon the system after being attended, producing a single waiting line.

Elements that after being processed in a workstation, are moved to somewhere else to be submitted to other type of process, producing multiple waiting lines.

In the same way, Taha (2008) mentions that the principal actors in a queuing situation are the customer and the server. Customers are generated from a source. ON arrival at a service facility, they can start service immediately or wait in a queue if the facility is busy. When a facility completes a service, it automatically "pulls" a waiting customer, if any, from the queue. If the queue is empty, the facility becomes idle until a new customer arrives.

From the standpoint of analyzing queues, the arrival of customers is represented by the interarrival time between successive customers, and the service is described by the service time per customer. Generally, the interarrival and service times can be probabilistic, as in the operation of a post office, or deterministic, as in the arrival of applicants for job interviews.

Queue size plays a role in the analysis of queues, and it may have finite size, as in the buffer are between two successive machines, or it may be infinite, as in mail order facilities.

Queue discipline, which represents the order in which customers are selected from a queue, is an important factor in the analysis of queueing models. The most common discipline if first come, firs served (FCFS). Other disciplines include last come, first served (LCFS) and service in random order (SIRO). Customers may also be selected from the queue based on some order of priority. For example, rush jobs at a shop are processed ahead of regular jobs.

The queuing behavior of customers plays a role in waiting line analysis. "Human" customers may jockey from one queue to another in the hope of reducing waiting time. They may also balk from joining a queue altogether because of anticipated long delay, or they may renege from a queue because they have been waiting for too long.

The design of the service facility may include parallel servers (e.g., post office of bank operation). The servers may also be arranged in series (e.g., jobs processed on successive machines), or they may be networked (e.g., routers in a computer network).

The source from which customers are generated may be finite or infinite. A finite source limits the customers arriving for service (e.g., machines requesting the service of a repairperson). An infinite source is forever abundant (e.g., calls arriving at a telephone exchange).

Variations in the elements of a queuing situation give rise to a variety of queuing models.

For Hiller and Lieberman (2010), the M/M/s model assumes that all interarrival times are independently and identically distributed according to an exponential distribution (i.e., the input process is Poisson), that all service times are independent and identically distributed according to another exponential distribution, and that the number of servers is s (any positive integer).

Consequently, this model is just the special case of the birth-and-death process where the queueing system's mean arrival rate and mean service rate per busy server are constant (λ and μ, respectively) regardless of the state of the system. When the system has just a single server (s 1), the implication is that the parameters for the birthand-death process are $\lambda n = \lambda$ (n 0, 1, 2, . . .) and $\mu n = \mu$ (n 1, 2, . . .).

When $\lambda \geq \mu$, so that the mean arrival rate exceeds the mean service rate, the preceding solution "blows up" (because the summation for computing P0 diverges). For this case, the queue would "explode" and grow without bound. If the queueing system begins operation with no customers present, the server might succeed in keeping up with arriving customers over a short period of time, but this is impossible in the long run. (Even when $\lambda = \mu$, the expected number of customers in the queueing system slowly grows without bound over time because, even though a temporary return to no customers present always is possible, the probabilities of huge numbers of customers present become increasingly significant over time.)

Queuing theory is a tool, it is not an optimization technique, it uses analytic formulas under mathematical assumptions, which give an approach to a problem, under a low cost, and provide information about how the waiting line behaves; in order to solve real problems regarding the service and/or to efficient the line.

According Hiller and Lieberman (2010), queueing systems are prevalent throughout society. The adequacy of these systems can have an important effect on the quality of life and productivity. Queueing theory studies queueing systems by formulating mathematical models of their operation and then using these models to derive measures of performance.

This analysis provides vital information for effectively designing queueing systems that achieve an appropriate balance between the cost of providing a service and the cost associated with waiting for that service.

Statistical model

According to Walpone et al. (2012), the fit test of a statistical model describes how good it is adjusted a set of observations. In general, the goodness-of-fit test resumes the discrepancy between observed values and expected values of a study model. Those measures can be applied in the hypothesis contrast and check if two samples are obtained as of two identical distributions, or if the frequencies follow a specific Chi-Squared distribution. The Pearson's X^2Test is considered as a non-parametric test that measures the discrepancy between an observed distribution and a theorical distribution (Goodness-of-fit test), indicating to what extent the differences between the two, if any, are random in contrast to hypothesis. It is also used to prove the independence of two variables among each other, by presenting data in crosstabs. The formula given by the statistician is:

$$x^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} \tag{1}$$

The greater the value of X^2, the less plausible is that the hypothesis is correct. In the same way, the closer the value of X^2 is to zero, the more adjusted are both distributions. The degrees of freedom are: gl= (r-1) (k-1), where r refers to the number of rows and k to the number of columns.

Decision criteria: Ho is not rejected when $X^2 < X^2$t(r-1) (k-1). On the contrary case, it is rejected. T represents the table provided value, according to the chosen statistical margin of error.

The following hypothesis are proposed from the observed data below, divided among the intervals:

Ho: Data are behaved exponentially.

Ha: Data are not behaved exponentially.

Case Study

Problem Statement

Customers of the gas stations waiting in line to obtain a service to their cars, continuously block the street lanes, mostly on rush hours.

Consequently, it is pursued to obtain information related to the service efficiency and define those waiting lines behavior, for the purpose of determining the cause of these lines, a capacity problem or simply the novelty of a new gas station or the rushing hours.

Materials and methods

This research is developed with a quantitative approach of descriptive type, because the statistical sampling technique was applied to numerical data, in the interest of validating the information search; and subsequently, it was used to describe the waiting line behavior.

Preliminary analysis:

A preliminary analysis was applied at the gas station, which has three service stations, each of them with two fuel dispensers; this was the taken population to determine the sampling size. In the same way, those criteria were applied to time taking.

This analysis was developed with Kendall's notation for M/M/S queuing model, according to Hillier & Lieberman (2010). The nomenclature used is specified below:

λ: Average arrival rate in time unit

$1 / \lambda$: Time between customer arrivals

μ: Average service rate

$1 / \mu$: Service time

S: Number of servers

Sampling size determination

To initiate the job, the sample size that will be used along the process is required. For that, it was used the following formula to calculate statistical "n" with a 5% margin of error and a 95% confidence level:

$$n = \frac{(Z^2 pq)}{e^2} \qquad (2)$$

$$n = \frac{(1.962)(1.3115)}{0.01178}$$

n=427.6058

n=428

Time taking

An Excel table was designed to register input and output variables, which includes register columns of minute, arrival time, service start and service end. The sampling was carried out along a month, in different schedules and looking to cover the lapse in which the gas station has the more vehicles; besides the consideration of the different week days, including normal work days and holidays. As of the mentioned data, the waiting line time and the service time was calculated, as well as the quantity of arriving vehicles. Table 1 shows the used format to time taking.

Min	Check In	Service start	End of service	Time in line	Service time	Vehicles / minute

Table 1 Register format for each station

Statistical test

Subsequently in the procedure, a Goodness-of-fit Test was executed to the statistical processing of Chi-Squared (Tables 2 and 3), in order to validate the application of the waiting line model, as Poisson distribution in the arrival rate, and as an exponential distribution in the service rate.

To validate the arrival rate, a histogram was created with the collected data, as a result, it was obtained the expected frequency for each value; as of the frequency it was calculated the interval probability using the Poisson probability function:

$$P(x) = \frac{\lambda^x e^\lambda}{x!} \qquad (3)$$

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Following, the expected frequency Ei was calculated as of the proposed probability function and finally, the statistical test was calculated.

$$x^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} \qquad (4)$$

To validate the service rate, because it is a continuous variable, the probability was calculated with the formula:

$$P(x) = 1 - e^{-\frac{x}{\lambda}} \qquad (5)$$

Next, the expected frequency and the statistical test were calculated.

In Tables 2 and 3, it is shown a resume of the parameter calculation for arrival and service rates, including the margin of error for each test.

	Interval	Oi	Ei	Error
$\lambda = 0.5053$	0	231	245.4390	0.8494
n = 428	1	156	136.4824	2.7911
	2	41	37.9472	0.2456
		428		
			X^2_0	3.8861
			$X^2_{0.05,2}$	5.99

Table 2 Arrival rate to the station

	Interval	Oi	Ei	Error
$\lambda = 0.5053$	0-1	165	169.77776	0.134452184
n = 428	1.01-2	120	102.430826	3.013505671
$\mu = 1.9790$	2.01-3	70	61.7988722	1.088345059
	3.01-4	40	37.2846804	0.19774772
	4.01-5	25	22.4947049	0.279021377
	4.01-MAX	8	0	0
			X^2_0	4.713072011
			$X^2_{0.05,2}$	5.99

Table 3 Service rate in the station

The X^2_0 test value compared to the critical value $X^2_{0.05,2}$, with a 95% confidence level is minor in both cases, indicating that data follow a Poisson and exponential distribution respectively, therefore, a MM1 waiting line model can be applied. The MM1 model uses a Poisson arrival time with λ parameter and exponential service time with μ parameter, for a server, with discipline service first to arrive First Come First Served (FCFS), in which the number of customers admitted by the server and the arrival source size are infinite. This model is the most analytically studied model.

Output variables calculation:

Based on the data obtained from time taking, values of μ and λ are determined, which are defined as service rate and arrival rate respectively. The calculation of output variables was made applying the waiting line model mentioned above, by using the QM For Windows software. Results are shown in Tables 4, 5, and 6, and Figure 1.

Table 4 Station data

Table 5 Model results
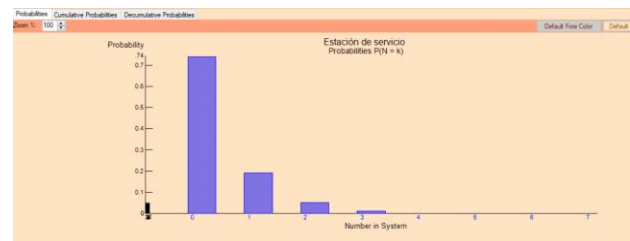
Figure 1 Cumulative probabilities

k	Prob (num in sys = k)	Prob (num in sys <= k)	Prob (num in sys >k)
0	.74	.74	.26
1	.19	.93	.07
2	.05	.98	.02
3	.01	1	.0
4	.0	1	.0
5	0	1	0
6	0	1	0
7	0	1	0

Table 6 Probabilities table

The analysis performed with the software threw the following results:

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- The customers arrival rate is 0.5 customers per minute (λ).

- The service rate is 1.979 customers per minute (μ).

- The number of customers in the system is 1.

- The waiting time in the system is less than a minute.

- The length of the line is 0.0875 vehicles, hence, there is almost no line.

- The time vehicles wait in line is 0.1732 minutes.

- The probability of existing 0 customers in the system is 74%.

- There is only a 26% use of fuel dispensers (efficiency).

Conclusion

On balance, in spite of the vehicles arrival per minute is relatively good, the percentage of use is very low, the statistics is not very encouraging, and the most alarming data is that the probability of finding the system unoccupied 74%, in other words, the system is held more time unoccupied than occupied; there is only a 26% use of the fuel dispensers. It was also found that the most affluence of vehicles is at the work and/or school arrival or departure hours; consequently, the time out of rush hours presents a poor vehicular affluence. Some recommendations are the search of strategies to give more diffusion to the gas station, develop a marketing campaign, efficient the service regarding the dispatcher, analyze if there is required to have two workers in each fuel dispenser, because those salary expenses could not be correctly exploited, due to the low use of each station. Nevertheless, the main strategy must focus on attracting a bigger number of customers to the system.

It is also convenient to study the waiting line behavior, considering the different variables that affect it, such as the day of the week, the time of day, holidays, among others, in order to adjust the strategies to be performed.

The approach used in this waiting lines research can be apply later to the implementation of different strategies, with the purpose of following up to the obtained results and carrying out its control; this supports the taking of decisions and helps the improvement of customer service process.

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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

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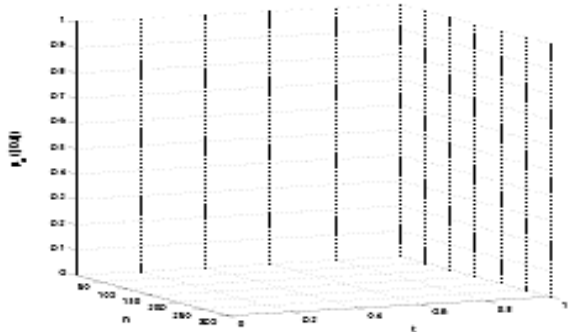
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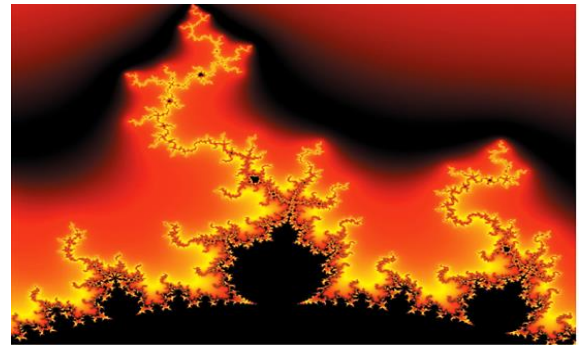Should not be images-everything must be editable.

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

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The results shall be by section of the article.

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Explain clearly the results and possibilities of improvement.

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