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Journal of Business Development Strategies

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Article

Quality of service in the Heineken supply chain, México: an empirical investigation in the west of Mexico

Calidad de servicio en la cadena de suministro de Heineken, México: una investigación empírica en el occidente de México

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Abstract

The general objective of this work is to analyze the quality factors of the supply chain service in the western regional direction of the company Cervezas Cuauhtémoc Moctezuma - Heineken México. The analysis was framed in a model proposed by Gohain, Thambiah and Hong (2018) which measures six dimensions of service quality: the object, the process, the infrastructure, the interaction, the environment and social responsibility. A survey was applied as an instrument to collect the responses of active providers in the western region of Mexico. The results were estimated by using STATA 14 to evaluate the relationship between the proposed factors. The results highlight that the quality of the supply chain is influenced by the quality criteria of the product, the process and the interaction. In this way, this research contributes with relevant information that allows them to make quick and practical decisions to use those responsible for the company's supply chain, as well as other economic sectors.

Supply chain, Service quality, Suppliers, Logistics regression

Resumen

El objetivo general del presente trabajo es analizar los factores de calidad del servicio de la cadena de suministro en la dirección regional occidente, de la empresa Cervezas Cuauhtémoc Moctezuma – Heineken México. El análisis se enmarcó en un modelo propuesto por Gohain, Thambiah y Hong (2018) el cual mide de seis dimensiones de la calidad del servicio: del objeto, del proceso, de la infraestructura, de la interacción, del ambiente y de la responsabilidad social. Se aplicó una encuesta como un instrumento para recopilar las respuestas de los proveedores activos en la región occidente de México. Los resultados fueron estimados mediante el uso de STATA 14 para evaluar la relación entre los factores propuestos. Los resultados destacan que la calidad de la cadena de suministro se ve influenciada por los criterios de calidad del producto, del proceso y por la interacción. De este modo, esta investigación contribuye con información relevante que les permita tomar decisiones rápidas y prácticas de usar a los responsables de la cadena de abastecimiento de la empresa, así como de otros sectores económicos.

Cadena de suministro, Calidad del servicio, Proveedores, Regersión logística

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Introducction

The evaluation of suppliers is one of the fields of the supply chain (CS) with contributions to management, since the impact on costs and inventories is decisive for the effectiveness of company operations (Arango-Serna, Adarme-Jaime, & Zapata-Cortes, 2013).

Currently, competitiveness, technological changes, the ephemeral life cycles of goods, the reduction of hidden costs, the outsourcing of these, digital business opportunities, as well as the trend towards sustainable businesses, have led companies to focus to improve their processes to be able to stand out from their competitors. This makes it necessary for companies to direct their attention to the management of suppliers, in such a way that they can control costs, losses and increase the efficiency of their operations. These actions also make it possible to take care of the relationship with customers, the levels of service, the efficient response to the customer, as well as their satisfaction.

From previous decades, business efficiency strategies include improvements in logistics and supply systems, as evidenced by studies on warehouse management (Mejía & Higuita, 2015) and service strategies according to customer needs (Correa, Gómez, & Cano, 2010).

Currently, research on the supply chain to make purchases of goods and services is focused on generating models that obtain different variables from the decision process.

A supply chain is an integrated process in which two or more companies (such as suppliers, distributors and manufacturers) coordinate the sale of raw materials, for the transformation of final products and / or the marketing of the latter for the sale of details. The number of nodes, stages and the structure of the flow of materials and information contributes to determining the complexity of the supply chain (Arango-Serna, Adarme-Jaime, & Zapata-Cortes, 2013). The models for planning a CS operation can be classified into three groups (Mejía & Higuita, 2015): strategic, tactical and operational.

Strategic models work with horizons of five to ten years, and affect the long-term performance of the system from a CS planning and design perspective. The operational models work with very small intervals of time, from one to two weeks, and consider the sequencing of operations and timing of productive tasks. Finally, the tactical models are located in the middle of the previous ones. These models work with planning horizons of one to two years, and incorporate some characteristics of both the operational and strategic models (Pérez-Armayor, León-Alen, Racet-Valdés, & Díaz-Batista, 2013).

According to Ruiz, Ablanedo and Ayala (2012) they manage related variables in a SWOT analysis (Strengths, Opportunities, Weaknesses and Threats) for each provider. These authors point out the importance of knowing the strengths and weaknesses of the providers, lies in identifying in which activities they are competent to continue developing both the provider that owns them and the rest of the providers, in order to develop them with the appropriate characteristics for the supply chain of goods and services they perform, benefiting CM with competent suppliers. On the other hand, for Zutshi and Creed (2009) the weaknesses are important to know about them, since they create inconveniences in the established plans. Resulting in not meeting the supply chain objectives and eliminating them, the analyzed company is being further strengthened, ensuring the success of the established objectives.

A current indicator to consider when choosing suppliers is to take them as an integral part of the supply chain. In this regard, Vijay, (2006) and Jae-Eun and Brenda, (2008) establish that no company competes alone. With this principle, they establish that integration and management in interaction with suppliers are registered today as one of the important columns for sustainable competitive advantage. For Araz, and Ozkarahan (2007), the supplier-client relationship is established by proposing a model in supplier management that allows building relationships of mutual trust, increasing the scope of planning and the level of cooperative activity.

For Narasimhan, Talluri, and Méndez, (2004), the establishment of partnerships and alliances between companies and their suppliers is an important manifestation of their ability to acquire competitive advantages.

In accordance with the above, it is important to mention the importance of identifying a reliable supplier base to develop them and make them business partners; those who do not have the necessary participation characteristics for the purchasing company will need to be eliminated from the supplier base with which is counted. Pérez-Armayor, León-Alen, Racet-Valdés and Díaz-Batista (2013), establish that it is necessary to develop a requalification process towards suppliers in order to reduce it and have a smaller set of possible suppliers.

That is why, the evaluation of suppliers is one of the fields of greatest interest for both academics and entrepreneurs, due to the effect it has on cost control, as well as on the improvement of the level of service in CS, both for suppliers as for buyers. Thus, this article analyzes the quality factors of the supply chain service in the western regional direction of the company Cervezas Cuauhtémoc Moctezuma - Heineken México.

The article is organized as follows. The conceptual framework is first exposed. Subsequently, the methodology implemented for the analysis of the information is exposed. Finally, the conclusions and future lines of research are explained.

Literature Review

Supply chain

According to Handfield and Nichols (1999), supply chains include all those activities associated with the flow and transformation of products from raw materials or inputs directed to the final consumer.
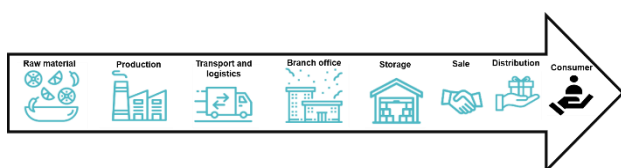
Figure 1 Representation of the basic elements of a supply chain

For the study company it is of utmost importance to have commercial partners committed to the quality of service in the supply chain and in each of its activities carried out in the transformation of raw materials to required products, hence the importance of the study carried out , with the aim of knowing areas of opportunity both internally and externally and developing strategic plans to improve the execution processes of this. Achieving an optimal two-way partnership between organizations is achieved through effective management of service indicators and a clear understanding of the needs of both parties. For Grönroos (1994), the quality of the service depends on the comparison of the expected service with the perceived service.

Currently, in accordance with the demands of globalization, it is of utmost importance to establish competitive advantages in supply chains that allow adaptation to dynamic changes in markets. Profitability and shorter delivery time are some indicators that are optimized by improving Supply Chain. For this reason, it is important to standardize the quality of the supply chain service and thus perform excellent performance, which in turn enables savings to be generated and is reflected in the increase in utility and customer satisfaction.

For this reason, it is of utmost importance to constantly work on developing the supply chain, seeking to be effective in the competitive environment in which it develops, analyzing the opportunities and threats to have an advantage over the competition, such advantage should be used to stay in the competitive market in which it develops. According to Chen and Li (2005), who stated that establishing a sourcing strategy allows lasting competitive advantages to be achieved, by strengthening relationships with suppliers and open communication between members of the supply chain, this collaboration creates a business strategy in order to optimize the relationship with the manufacturer, distributor and customer.

To ensure the excellent performance of the supply chain, it is advisable to effectively evaluate and select the best suppliers, in this way the development of the suppliers guarantees and improves their long-term performance, establishing joint work plans in a competitive manner. . For Narasimhan, Talluri, and Méndez, (2004), the establishment of partnerships and alliances between companies and their suppliers is an important manifestation of their ability to acquire competitive advantages. Main aspect to guarantee the quality of the supply chain service and thus generate better levels of competitiveness in the purchasing process by knowing how to select and evaluate correctly and in a timely manner the supplier base with which it has.

The constant changes in consumer tastes make it necessary that, although there is already a developed supplier base, sometimes new suppliers must be acquired, being the step that takes the most time for the evaluation process, since it must search for and know your clients, experience, possible certifications, among many other things. In order to identify if they are related to the study company and can cover the needs that are required, without forgetting the follow-up or accompaniment to be carried out so that the new supplier becomes familiar with the way the company operates, payment conditions, quality policies, delivery times among many other things.

Together, it is important to acknowledge the contributions of Vollmann, William, and Waybark. (2005), establish a set of world-class actions important for successful integration and development with suppliers. These include: the participation of the supplier in the design of new products and processes, the promotion of training programs for suppliers, the transfer of knowledge and the creation of supplier support centers.

Currently it is possible to have fast and timely contact between the fundamental parts of the supply chain, it should not be forgotten that current requirements make delivery times much faster and in turn allow real-time traceability of the movement of goods. For this reason, the supply chain constantly evolves in the tireless search for customer satisfaction.

For the company under study, this evolution, although it provides considerable benefits such as greater knowledge of the products offered by suppliers, also presents considerable challenges.

Such as supporting suppliers in improving their production processes and establishing appropriate conditions for the development of sustainable products, emphasizing the quality of service in the supply chain. Hence the importance of carrying out this study in order to know the indicators that allow the optimum performance of the supply chain of the company under study to be measured and to seek continuous improvement.

In accordance with the aforementioned and for the case of this study, the following indicators are described in order to be able to standardize the quality of service process in the supply chain and identify areas of opportunity, for which reason the following is done description of these.

Quality of service

A transnational company like the one in this research are more likely to change providers. Quality measurement is one of the research strategies for business. The extensive range of research in this area shows its importance for continuous improvement strategies in companies (Gohain, Thambiah, & Hong, 2018; Mejía & Higuita, 2015; Cardona & Bravo, 2012; Zineldin & Vasicheva, 2012). Regardless of the fact that research shows sometimes inconsistent results, the field of service quality has led to the development of various theories and service models. One of the pioneers on this issue were Parasuraman and the SERVQUAL model and the Grönroos model and quality gaps. These measures have produced mixed results that encompass the freedom to create and explore new attributes, highlighting the absolute scale of service quality.

Customer satisfaction

Satisfaction is understood as "the consumer's reaction to the service experience. Customer satisfaction is the main objective of any supply system, as this results in better quality in the customer-supplier relationship.

The level of satisfaction It is directly perceived only by the person who lives the service experience. Assessing customer satisfaction is finding evidence about the attention given to the structure, processes and results of the services provided.

Thus, the concept of customer satisfaction is key to the continuous improvement of supply chain services. However, there are a multitude of models and dimensions that have been applied and evaluated to different business sectors and sizes, to different social strata, in different contexts and markets, as well as different cultural conditions. Despite this, one of the important reasons for the study of service quality continues to be evaluation from the customer's perspective, which has a direct impact on customer satisfaction.

Therefore, in this research, quality was analyzed based on the model proposed by Gohain, Thambiah and Hong (2018) which measures six dimensions of service quality: the object, the process, the infrastructure, the interaction, environment and social responsibility. These dimensions are defined as:

- Object Quality of Service (CSO): explains the technical quality of the product or central service that the customer receives.

- Process Quality of Service (CSP): explores the quality that the product or service provider gives to the main product or service.

- Infrastructure Quality of Service (CSINF): refers to the resources necessary for the realization of the product or service.

- Interaction Quality of Service (CSINT): Explains the quality of data exchange, financial exchange, and social interaction.

- Environment Quality of Service (CSA): explores the environmental context in which the provider-client relationship occurs, influenced by the functional environment of this interaction.

- Quality of service of social responsibility (CSRS): this indicator measures the feedback on care and the actions that providers carry out in favor of the company and society in general.

Methodology

The information was collected through a questionnaire self-administered by the providers. Regarding the sample, this was probabilistic, applying the questionnaire to the 248 providers who provide their services to DR West in the states: Jalisco, Colima, Guanajuato, Michoacán, Aguascalientes, Zacatecas. So the selection of variables was as follows:

Factors	Indicator
Service satisfaction (SS)	Satisfaction of the required service
Object Quality of Service (CSO)	The established time for the delivery of the product and / or required service is fulfilled.
Process quality of service (CSP)	It offers guarantee on the product and / or service that are required by the client
Infrastructure Quality of Service (CSINF)	Updates its existence (stock) according to the new products and / or services that come onto the market.
Interaction Quality of Service (CSINT)	Time to resolve customer complaints
Environment Quality of Service (CSA)	¿Do you have policies, programs and strategies that favor the full human development of your collaborators?
	¿Do you provide your collaborators with the appropriate personal protective equipment to carry out their activities and guarantee their safety and integrity against the risks of the work they do?
Quality of social responsibility service (CSRS)	¿Do you have any certification that guarantees the efficient use of water, energy and waste management produced by your activity?
	¿Is there feedback from the client about industrial safety and environmental impact actions?

Table 1 Analysis factors

Research Findings

As part of the statistical methods applied in this research, there is the correlation analysis, which was applied in order to measure the degree of linear relationship between each of the variables studied. The main statistical method that was used was the logit logistic regression to estimate the causality between the independent variables CSO; CSP; CSINF; CSINT; CSA and CSRS, with the dependent SS. First, the correlation between the established indicators was analyzed, obtaining the following results:

Dependent variable	
Quality of service (CS)	
Independent variable	
Object Quality of Service (CSO)	0.3453*
Process quality of service (CSP)	0.4412*
Infrastructure Quality of Service (CSINF)	0.0982
Interaction Quality of Service (CSINT)	0.2534*
Environment Quality of Service (CSA)	0.0909
Quality of social responsibility service (CSRS)	0.2070*
Note: * significant at 0.05.	

Table 2 Variable correlations
Source: Self made based on STATA 14.

Once the correlation between the indicators to be analyzed was determined, a logit logistic regression was applied for SS & CSO, CSP and CSINT., Obtaining the following results:

I.V.	Estimator	Std. Err.	P valor	Probability ratio
CSO	1.0202	0.2231	0.0188 **	2.7736
CSP	0.4875	0.1242	0.0000***	1.987294
CSINT	0.5030	0.2708	0.0633*	1.653729
CSRS	0.4875	0.1242	0.0000***	1.628217
Interceptor	-8.6238	1.4755	0.0000***	
Note: *** significant at 0.00%; ** significant at 0.01%; *significant at 0.05%.				

Table 3 Logistic regression logit of supply service satisfaction
Source: Self made based on STATA 14

In the previous results it is observed that the significant and positive indicators were the CSO, CSP, CSINT and CSRS activities. Thus, according to the model proposed by Gohain, Thambiah and Hong (2018) 4 of the 6 dimensions of service quality, related in this research: the quality of service of the object (CSO), of the processes (CSP), interaction (CSINT) and social responsibility (CSRSC).

In operational terms, the satisfaction of the supply service is related to compliance with the established delivery time, compliance with the supplier's guarantee, attention and resolution of complaints, as well as the feedback of activities on safety and environmental impact that the providers perform.

Regarding the probability ratio, it is observed that the CSO factor, in the indicator of compliance with the established delivery time, is 2.77 times more likely to influence service satisfaction. For its part, the CSP factor in terms of compliance with the supplier's guarantee, this is 1.98 times more likely to affect service satisfaction. The CSINT fator in reference to the attention and resolution of complaints, has a 1.65 more probability. Finally, the CSRSC factor in relation to the feedback of the activities on safety and environmental impact that providers carry out, has a 1.62-fold impact on service satisfaction.

Once the factor estimates were obtained, the Analysis of Variance (ANOVA) was applied, where the significance of the variables was checked: SS & CSO, CSP, CSINT and CSRS.

I. V.	LR Chisq	Df	Pr (>Chisq)
CSO	30.0478	1	0.0000 ***
CSP	5.6930	1	0.0170 **
CSINT	3.4363	1	0.0637*
CSRS	16.5233	1	0.0000 ***
Note: *** significant at 0.00%; ** significant at 0.01%; *significant at 0.05%.			

Table 4 ANOVA test
Source: Self made based on STATA 14

With this analysis anova, it is evident that the factors of the quality of the object (CSO), the process (CSP), the facilities (CSINT) and the social responsibility (CSRS) influence the perceived quality. In this way, the robustness of the analyzes carried out is verified, where the indicators were significant at .01 and at .001%.

Discussion and Conclusion

Based on the information presented in this investigation, it is observed that the main objective was achieved, by evaluating the quality of the service provided in the Heineken company supply chain. The analysis of the evaluated factors allowed knowing the most important factors that determine the quality of the service.

It is observed that the CSO, CSP, CSINT and CSRS factors were significant in relation to the dependent variable. Thus, the indicators of: delivery time, supplier guarantee, attention and resolution of complaints and the feedback of the activities on safety and environmental impact that the suppliers carry out are decisive for the quality of the service. These results are in agreement with that stated by Gohain, Thambiah and Hong (2018).

According to Mantilla and Sánchez (2012), they analyze that the time factor adds value in the supply chain and that it represents 10%; followed by order processing activities (supplier guarantee, attention and resolution of complaints), and logistics activities (safety and environmental impact).

Continuing with the above, the tangible elements (CSO and CSP), together with the intangible elements (CSINT and CSRS) are decisive for the quality of the service. In this way, it can be argued that supplier evaluation is a fundamental part of the supply chain, due, among other things, to the fact that it is the starting point for marketing companies as the case study of this research.

Suggestions for future research

It is for this reason that the constant evaluation of the quality of the service contributes to the identification of areas of opportunity within the productive system of any company, thus contributing to the continuous search for effective strategies that allow continuous improvement. The orientation to improve satisfaction levels, either in services or products, is to identify and adjust to the needs of the market.

The work of senior management requires identifying these areas of opportunity to manage a change that contributes to solving problems, whether in processes, delivery or after-sales service, thus achieving leverage competitive advantages.

Research limitation

Among the possible limitations presented by this research, the lack of complexity in the analyzed variables can be mentioned. As future lines of research in this topic is the analysis of more cases of application of the factors found, related to additional elements of companies such as size, seniority, educational level of the manager, among other characteristics to validate different companies in other sectors. and sizes.

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Use of management indicators in the Valle de Aguascalientes industrial park

Uso de indicadores gerenciales en el parque industrial del Valle de Aguascalientes

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Abstract

This research is the result of 3 investigations carried out in three of the main Industrial Parks of the state of Aguascalientes, Mexico. The industrial parks on which this research is based are the San Francisco de los Romo Park, the Industrial Park of the Aguascalientes Valley, known as PIVA and the Santa Clara Park. The purpose of this paper is to investigate which are the Management Indicators used by the Automotive companies in the Industrial Park of the Aguascalientes Valley. The most important aspects of the companies they incur in implementing the management indicators of the areas of:

- Administration.
- Human Resources.
- Production.
- Logistics.
- Maintenance.

Resumen

Esta investigación es el resultado de 3 investigaciones realizadas en tres de los principales Parques Industriales del estado de Aguascalientes, México. Los parques industriales en los cuales se basa esta investigación son el San Francisco de los Romo, el Parque Industrial del Valle de Aguascalientes, conocido como PIVA y el Parque Santa Clara. El presente trabajo tiene como objeto investigar cuales son los los Indicadores Gerenciales que utilizan las empresas Automotrices en el Parque Industrial del Valle de Aguascalientes. Se analiza los aspectos más importantes de las empresas en los que incurren al implementar los indicadores gerenciales de las áreas de:

- Administración.
- Recursos Humanos.
- Producción.
- Logistica.
- Mantenimiento.

KPI, Management Indicators, Automotive Industry, Aguascalientes

KPI, Indicadores Gerenciales, Industria Automotriz, Aguascalientes

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Introduction

This report presents an analysis of the use of Managerial Indicators in automotive companies in the San Francisco de los Romo Industrial Park.

A survey was carried out to analyze the use of these Indicators, here the necessary questions were formulated to contemplate the most important KPI's within an automotive company. The areas of the companies where the use of indicators was contemplated are:

- Administration.

- Human Resources.

- Production.

- Logistics.

- Maintenance.

The results of the survey applied to a sample of 4 companies from a universe of 1 company that correspond to 36% of the automotive industry in said park are shown below.

This project benefits the automotive and metal mechanical industries as it allows us to know what the strengths and weaknesses are regarding the use of these indicators in this industrial park.

Methodology

According to Hernández Sampieri (2010) the study that was applied was a "Quantitative Exploratory" study where a survey-type data recovery tool will be used.

Sampling

The type of sampling that was carried out was stratified. The advantage of this type of sampling is that it tends to ensure that the sample adequately represents the population based on selected variables. It also allows obtaining more precise estimates and its objective is to obtain a sample that is as similar as possible to the population in terms of the stratified variable (s).

The result was a sample of 4 companies out of 11 registered as automotive companies. Which represents 36% of the companies that could be explored.

Automotive companies in the industrial park of San Francisco de los Romo Aguascalientes
- San-s Mexicana SA de CV.
- K&S Mexicana Harness Systems.
- Gestamp México SA de CV.
- Kotobukiya Treves from Mexico.
- Sacred Mexicana SA de CV.
- Calsonic Kansei.
- Mabuchi Motor.
- Suncall.
- Sumimoto.
- ITW Automotive Products México SA de CV.

Table 1

Background

Currently, to measure and improve their processes, companies use statistical measures based on the objective of evaluating the performance of an organization, a system or a process through indicators. The evolution of the concept of metrics in quality management, as explained by Professor Michael A. Noble of the University of British Columbia, has been radically transformed in recent decades.

The dates of how the stages for the development of an indicator were named are listed below.

1920: plan - do - see (Walter A. Shewart).

1940: plan - do - check - take action (J. Edwards Deming).

1980: define - measure - analyze - improve - control (Bob Galvin).

Today: normalization. The era of ISO 9001 quality indicators and the rest of the families.

Companies must determine, collect and analyze the appropriate data to demonstrate the adequacy and efficiency of the quality management system and assess where it is necessary to apply continuous improvement to optimize their processes. For this it will mainly measure: efficiency, effectiveness and productivity, based on ISO 9001: 2015.

The elementary information that this normative framework offers us is that they limit efficiency as the degree to which planned activities are carried out and planned results are achieved, it tells us about productivity as the relationship between the result achieved and the resources used, and the efficiency as a relationship between the result achieved and the resources used.

Performance indicators are measurements that are made in the different stages of the vital processes of the company in order to identify with the greatest objectivity possible the degree to which said stage is contributing or harming the achievement of strategic objectives. These stages range from the inputs that a company requires to function, through the internal processes of transformation of said inputs, until reaching the deliverables to the final customers.

For the application of the use of managerial indicators in industrial parks, it is necessary to carry out a questionnaire that is divided into 5 areas to analyze such as maintenance, administration, logistics, human resources and production, each of the areas contains in turn 10 indicators. which serve to know which ones are used by companies and which ones are not.

Below is the list of areas to analyze:

Administration

The administration department. It analyzes the processes, inputs and outputs, it also offers improvements in the company and, on the other hand, based on real numbers, it must know how to expose where it is possible to reduce costs and invest. In this way, you can increase your profits. It is not just a matter of keeping the documents up to date or of keeping the accounts well, but of having a broad vision of the company and showing areas for improvement.

The indicators of the administration area are:

- KPI administrative efficiency.

- KPI financial and budget information reports.

- KPI level of innovation of the company.

- KPI inventory turnover.

- KPI utility indices.

Human Resources

The task of this area is to carry out personnel planning, that is, to determine what is the need for labor that the company will have at a certain time, what type of profiles will be necessary, what type of contracts will be done and what will be its cost.

Its indicators are the following:

- KPI Growth rate on the learning curve.

- KPI Degree of satisfaction in Kpi training courses.

- KPI Compliance with hours of training classes.

- KPI Staff turnover.

- KPI Effectiveness of advertising in personnel searches.

- KPI Average time of unfilled vacancies.

- KPI Absence rate.

- KPI Compensation or benefit ratio.

- KPI Contract cost.

Production

It is the area whose main function is the transformation of raw materials into final products. It has several levels or positions within its hierarchical structure such as workshop operators, workshop managers or team leaders, production manager or production manager, production engineers or specialized technical staff.

Its indicators are the following:

- Returns KPI.

- KPI of rejections.

- Unplanned rush production KPI.

- KPI raw material stock.

- KPI raw material inventory turnover.

- KPI machinery delays.

- KPI demand forecast errors.

- KPI of input requirements.

- KPI effectiveness in compliance.

- KPI delivery effectiveness.

Logistics

This area is in charge of carrying out the planning and control of all activities related to the obtaining, storage and transfer of materials, whether from the raw materials necessary in the first stages of the production process to the finished products that go directly to the client. final.

The indicators of the logistics area are as follows:

- KPI orders delivered with claims.

- KPI cost of unit stored.

- KPI clearance compliance level.

- KPI unit costs dispatched.

- KPI units separated or dispatched per employee.

- KPI urgent shipments.

- KPI deliveries on time (%).

- KPI transportation costs (%).

- KPI operating cost per driver.

- KPI purchase order fulfillment.

Maintenance

In this area, activities of a technical-organizational nature are carried out to restore optimal operating conditions for equipment and machinery. This measure may or may not be previously prepared according to a plan that ensures the constant work of the teams, in addition to establishing the needs of human, material, financial resources and the organizational structure to achieve the objectives set by the implemented system.

The indicators in the maintenance area are:

- KPI corrective maintenance ratio vs. preventive.

- KPI preventive maintenance tasks completed on date.

- KPI response time of maintenance department.

- KPI maintenance cost per square meter.

- KPI number of incidents resolved by first plant level.

- KPI hours used for production and unemployment.

- KPI availability for breakdowns.

- KPI corrective index.

- KPI material consumption.

Results

Administration indicators

100% of the companies surveyed in the Parque Industrial Del Valle De Aguascalientes, use administrative efficiency in kpi, their objective is to obtain if operations are becoming more efficient.

In the kpi financial and budget information reports, it measures the elaboration of the part of expenditures by expenditure chapter of the quarterly report / No. of commitments x 100. 100% of the companies implement this indicator.

In the Valle de Aguascalientes Industrial Park, 67% of the companies use the company's innovation level kpi, the main objective of this indicator is to determine the company's degree of innovation in a given period. And 33% of companies do not implement it.
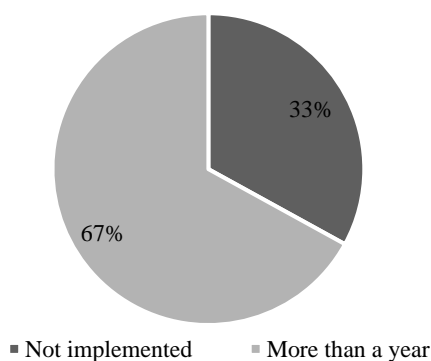
Graphic 1 Use of the company's innovation level KPI

The inventory turnover kpi 100% of the surveyed companies have more than one year applying this indicator which measures the average inventory / inventory turnover.

The KPI indices of profit, which measures net margin = net profit after taxes / sales. 100% of the companies surveyed in the Valle de Aguascalientes Industrial Park apply this indicator.

Human resources indicators

100% of the companies in the Parque Industrial Del Valle De Aguascalientes have been applying the kpi growth rate in the learning curve for more than one year, which measures the average level of grades in current exam / average level of grades in previous exam x 100.

The kpi degree of satisfaction in training courses, its metric is average level of qualification in current exam / average level of qualification in previous exam x 100. 100% of the companies surveyed in the Parque Industrial Del Valle De Aguascalientes implement it.

Of the companies surveyed in the Aguascalientes Valley Industrial Park, 33% have been implementing the KPI indicator for more than one year, compliance with training class hours, this indicator provides better control of compliance with training programs. 67% do not implement this indicator.
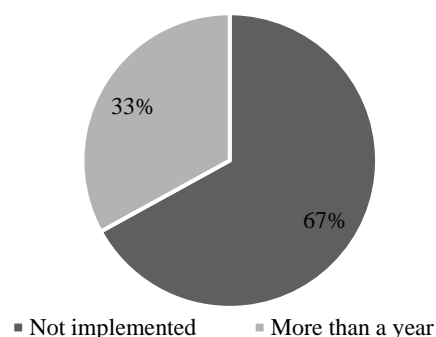
Graphic 2 Use of kpi compliance with training class hours

100% of the surveyed companies use the staff turnover kpi, which allows measuring the number of resignations / average number of permanent employees x 100.

Of the companies consulted in the Valle De Aguascalientes Industrial Park, 33% implement the kpi effectiveness of advertising in personnel searches, its measurement is the Number of CV to interview / total CV received, 67% of the companies do not is implemented by this indicator.
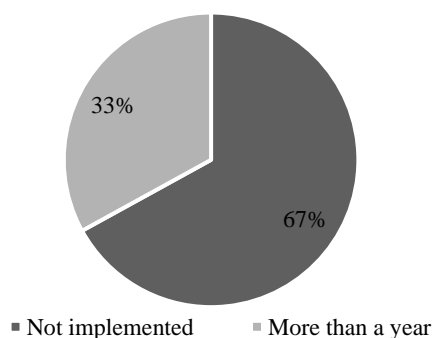
Graphic 3 Use of the advertising efficiency kpi in personnel searches

The KPI average time of vacancies not covered 67% of companies have more than one year using this indicator, its metric is days vacancies / number of open positions, 33% do not implement this indicator.

VAZQUEZ-GUTIERREZ, Rosa Inés, FLORES-AGUILAR, Mauricio and NÚÑEZ-MONTALVO, Juan Manuel. Use of management indicators in the Valle de Aguascalientes industrial park. Journal of Business Development Strategies. 2020

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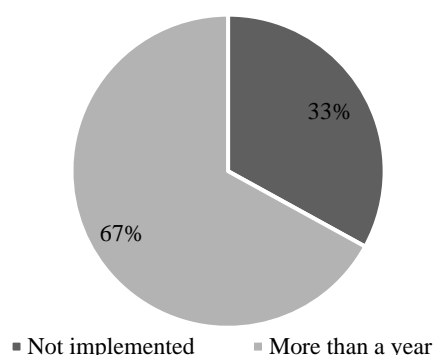
Graphic 4 Use of kpi average time of unfilled vacancies

From the companies consulted in the Valle de Aguascalientes Industrial Park, it was obtained that 100% implement the kpi absence rate. This indicator allows knowing the labor supply index within the company.

The compensation or benefit ratio kpi that measures the compensation or cost of benefits / income, the companies of the Parque Del Valle De Aguascalientes 100% have been implementing this indicator for more than one year.

Of the companies surveyed, 100% implement the hiring cost kpi, this indicator helps companies to know the expenses of personnel in a company such as gross salaries and social security charges.

Production indicators

Of the companies surveyed in the Parque Industrial Del Valle De Aguascalientes, 67% apply the return kpi, this indicator measures the amount of returned products / amount of total products shipped. 33% do not implement this indicator.
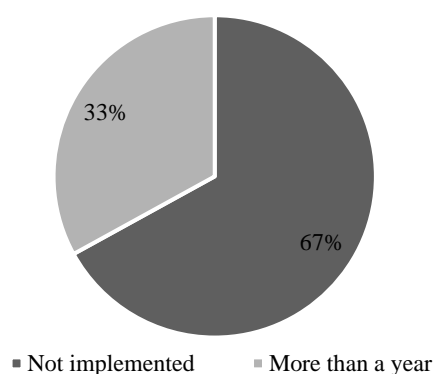
Graphic 5 Use of returns KPI

Of the companies surveyed, 100% apply the rejection kpi, its objective is to identify the product out of specifications and customer requirements.

100% of companies have implemented the kpi of unplanned urgent production for more than a year, this indicator helps companies to identify machine stoppages for various reasons.

The companies of the Parque Industrial Del Valle De Aguascalientes implement 100% the KPI stock of raw materials, to reduce the inventory of raw materials, finished products, containers, spare parts, etc.

The KPI inventory turnover of raw materials 100% of companies have been implementing this indicator for more than a year, its metric is cost of products sold / average stock of finished product.

A percentage of 100% of the surveyed companies was obtained on the application of the machinery delay kpi, this indicator has as main objective to keep the record of the operations to carry the delay indicators.

100% of the companies surveyed in the Valle De Aguascalientes Industrial Park have been implementing this indicator for demand forecast errors for more than a year, which allows taking into account the assertiveness of the forecasting method. KPI of input requirements 100% of the companies use this indicator, it allows to measure the quantity of inputs used / quantity of products.

Of the companies surveyed in the Parque Industrial Del Valle De Aguascalientes, 100% implement the KPI effectiveness in compliance, this indicator presents the key elements to consider to measure customer satisfaction regarding the design of the service that will be presented to the customer.
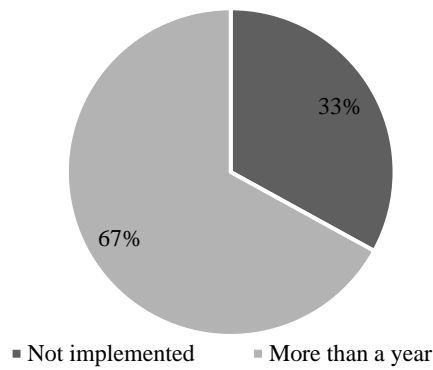
Graphic 6 Use of KPI delivery effectiveness

67% of the surveyed companies use the kpi effectiveness in delivery, this indicator allows to measure the days or hours of delay accumulated in the dispatches / N of dispatches made. 33% do not implement this indicator.

Logistics indicators

67% have more than a year applying the kpi delivery orders with claims, this indicator keeps track of orders that present claims or complaints because the product has arrived damaged or other causes. And 33% do not implement it.

The companies surveyed in the Parque Del Valle De Aguascalientes, 67% implement this indicator kpi cost of stored unit, its main objective is to control the unit value of the cost for its own distribution storage. 33% of companies do not implement it.

The KPI level of fulfillment dispatched 67% of the companies implement this indicator, its main objective is to control the efficiency of dispatches made by the distribution center. 33% of the companies in the Industrial Park Del Valle De Aguascalientes do not implement it.

100% of the companies surveyed in the Parque Industrial Del Valle De Aguascalientes apply the kpi cost unit dispatched, this indicator carries the percentage of handling per unit on the operating expenses of the distribution center.

Of the companies surveyed, 67% have been implementing this indicator kpi for more than a year, separate units or dispatched per employee, its metric is total units dispatched / total workers. 33% do not implement this indicator.
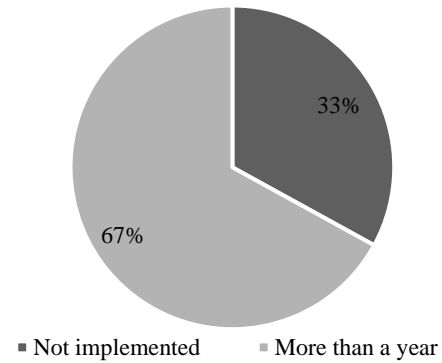
67% of the companies in the Parque Industrial Del Valle De Aguascalientes implement the kpi urgent shipments, this indicator helps to know the amount of shipments sent urgently against the total shipments dispatched. 33% of automotive companies do not implement it.

Graphic 7 Use KPI effectiveness in delivering express shipments

The indicator deliveries on time, its metric measures the number of deliveries on time / number of total deliveries x 100, 100% of companies implement it.

100% of the surveyed companies apply the kpi cost of transport to this indicator measures the cost of transport / total sales value x 100. The indicator kpi operating cost per driver is implemented by 33% of the companies surveyed in the Parque Industrial Del Valle De Aguascalientes, its measurement is the total cost of transportation / number of drivers. And 67% of companies do not implement this indicator.

100% of companies implement the purchase order fulfillment kpi, its objective is to measure the length of the supply chain in time.

Maintenance indicators

The corrective maintenance vs. preventive, measures the number of hours spent on corrective tasks / number of preventive tasks 100% of the companies surveyed have been implementing it for more than a year. The companies surveyed in the Parque Industrial Del Valle de Aguascalientes 100% implement the KPI preventive maintenance tasks completed on that date, this indicator aims to control that the prevention tasks are carried out and completed in the planned times.

100% of the surveyed companies have been implementing the maintenance department's response time kpi for more than a year, their objective is to develop fast and efficient order service processes.

Of the companies surveyed, 67% implement the maintenance cost kpi per square meter. This indicator measures the Number of incidents resolved by PNP / total number of reported incidents x 100. And 33% do not implement it.

Of the companies surveyed in the Valle De Aguascalientes Industrial Park, 67% implement the kpi number of incidents resolved by the first level of the plant, this indicator aims to eradicate the causes of complaints about damage to the products delivered. And 33% of companies do not implement this indicator.

The KPI hours used for production and those of unemployment, 100% of the companies of the Parque Industrial Del Valle De Aguascalientes use this indicator, it measures the hours of unemployment for maintenance / hours of production carried out x 100.

The companies in which the survey was carried out 100% apply the kpi availability due to breakdowns, which allows to know the availability due to breakdown all those scheduled stops of the equipment.

Of the companies surveyed, 100% have been implementing the corrective index kpi for more than a year, it is a useful indicator to implement a preventive maintenance plan in the plant.

100% of the companies in the Parque Industrial Del Valle De Aguascalientes use the material consumption indicator, its main objective is to identify the items referring to maintenance, modifications and new facilities.

Conclusions

Of the automotive companies analyzed, it can be seen that of the 5 groups that make up the total of managerial indicators, the following results were obtained:

In a group of Management Indicators made up of 5 attributes, it can be concluded that 80% of the indicators that make up this construct, companies take them to 100%.

For the group of Human Resources Indicators made up of 8 attributes, it can be concluded that only 62.3% of the indicators that make up this construct, the companies carry them to 100%.

The Production Indicators, made up of 9 attributes, represent the structure that is most met with a total of 89% of the indicators taken to 100% by each of the companies.

Regarding the Indicators that make up the Logistics construct, which are 9 attributes, only 33% of these indicators are taken to 100% by each of the companies surveyed, which represents the construct with the lowest rate of application of them.

And as regards the indicators that make up the maintenance contructo out of a total of 9 indicators, only 77% is taken to 100% by each of the companies surveyed.

Recommendations

It is recommended to carry out a root cause analysis to determine the origin of why the indicators have not been carried out 100% in those areas that are with a low percentage in their application, since they represent areas of great importance where it is unpredictable to have metrics or parameters to determine the application of improvements to make your processes more efficient.

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Challenges and perspectives for the implementation of Industry 4.0 in the Mexican industrial sector

Retos y perspectivas para la implementación de la Industria 4.0 en el sector industrial mexicano

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Abstract

The objective of this project is to implement an engineering proposal to optimize resources and tools, as well as knowledge methodologies to improve assets and carry out Industry 4.0 solutions, which will help manufacturing companies to be more efficient with said assets in every stage of the supply chain. This will allow them to keep up with inventory, quality and optimization opportunities related to logistics and development, assurance and changing flexibility to adapt to the technological pace of the new Industry 4.0. The implementation of the IoT (Internet of Things) will be vital for the operation of the factory, and thus be able to obtain better visibility of the assets worldwide. The project's contribution is to provide the information needed to streamline and adjust assets, so that standard asset management tasks such as asset transfers, dispositions, reclassifications, and adjustments can be streamlined and centrally managed in real time.

Industry 4.0, Methodologies, Supply chain, Optimization, Internet of things

Resumen

El objetivo del proyecto es implementar una propuesta de ingeniería para optimizar los recursos y herramientas, así como las metodologías del conocimiento para mejorar activos y llevar a cabo soluciones de la Industria 4.0, que ayudará a las empresas manufactureras a ser más eficientes con dichos activos en cada etapa de la cadena de suministro. Eso les permitirá mantener un mejor ritmo del inventario, la calidad y las oportunidades de optimización relacionadas con la logística y el desarrollo, el aseguramiento y la flexibilidad cambiante para adaptarse al ritmo tecnológico de la nueva Industria 4.0. La implementación del IoT (Internet of Things) será vital para el funcionamiento de la fábrica, y así poder obtener mejor visibilidad de los activos a nivel mundial. La contribución del proyecto es brindar la información necesaria para agilizar y ajustar activos, para que las tareas estándares de administración de activos, tales como transferencias, disposiciones, reclasificaciones y ajustes de activos puedan agilizarse y administrarse de manera central en tiempo real.

Industria 4.0, Metodologías, Cadena de suministro, Optimización, Internet of things

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† Researcher contributing first author.

Introduction

In essence, the new way of seeing the future of the industry is being developed with the name of "Industry 4.0" worldwide, and it is the commitment of every institution of Higher Education in the area of Engineering and Sciences to train university professionals and to look towards the future of future specialists, and to be concerned about the adaptation of these students to a globalized world that increasingly pushes the action of proposing projects that impact not only a changing social environment but also demanding to our industrial reality.

This theoretical and scientific implementation applied to the industry is directed towards the future and future of it, as well as the modification towards a reality overcome with the imagination, in which the technologies of the future create scenarios of an intelligent industry and an interconnection from the world to a network of technological changes and paradigms that are emerging in our XXI century.

The concept "Industry 4.0" also described as the "fourth industrial revolution", an intelligent industry or cyber industry of the future, which corresponds to a new way of organizing the means of production, to a vision of manufacturing, with all its interconnected processes through the Internet of Things (IoT), and thereby obtaining fully digitized and optimized smart factories (Smart Factory).

The fourth industrial revolution speaks of technologies and tools such as, for example, smart mobile devices, IoT platforms, geolocation technologies, advanced human interfaces, 3D printing, smart sensors, Big Data and advanced algorithms, augmented reality, cloud computing, nano and biotechnology or quantum computing, among others.

Its foundation consists in the digitization of industrial processes and the application of new manufacturing techniques that allow a new offer of products to the market, optimizing processes to increase quality and reduce losses, thereby achieving new business models in a globalized world.

Development of Sections and Sections of the Article with subsequent numbering

Problematic

At present, in many of the higher education institutions the study plans and programs are being updated to the rhythm of development of the global social need, which requires a type of professional competence in accordance with the development and the demanding and emerging utility; lies in satisfying a priority need of industrial evolution, Industry 4.0, the present and the future of an industry whose characteristic is constant transformation and emerging flexibility.

This lies in implementing new knowledge that will occur at the pace of globalization in a short time and, on the other hand, ensuring solutions in productivity needs and throughout the value chain that demand new knowledge based on emerging technology. That is why, with this project, we support the solution of current problems with the most relevant knowledge of Industry 4.0, as well as with its necessary and solid bases, such as IoT, Big Data, Artificial Intelligence, 3D Technology, by simulating processes with augmented reality, etc. And for this, it is necessary to update emerging knowledge for future graduates of the degree in Engineering.

Overall objective

Make the participant learn to optimize resources and tools, as well as knowledge methodologies to improve assets and carry out Industry 4.0 solutions that will help manufacturing companies to be more efficient with said assets at each stage of the supply chain . This will allow them to keep up with inventory, quality and optimization opportunities related to logistics and development, assurance and changing flexibility to adapt to the technological pace of the new Industry 4.0.

Specific objectives

- Implement IoT (Internet of Things) for the operation of the factory, and thus employees can get better visibility of their assets worldwide.

- Streamline and adjust assets, so that standard asset management tasks such as asset transfers, dispositions, reclassifications and adjustments can be streamlined and centrally managed in real time.

The first industrial revolution

The first industrial revolution happened between the end of the 18th century and the beginning of the 19th century. During this period, manufacturing evolved from a focus on manual work performed by people and with the help of work animals, to an optimized form of work performed by people through the use of engines that ran on water or steam and other type of tools and machinery.

The second industrial revolution

At the beginning of the 20th century, the world entered a second industrial revolution with the introduction of steel and the use of electricity in factories. The introduction of electricity allowed manufacturing companies to increase efficiency and made factory machinery more dynamic. It was during this phase that concepts of mass production, such as assembly line, were introduced as a way to increase productivity.

The third industrial revolution

Beginning in the late 1950s, the third industrial revolution began to emerge, as manufacturing companies began to incorporate more electronic technology - and eventually computers - into their factories. During this period, manufacturing companies began to experience a shift that placed less emphasis on analog and mechanical technology and more on digital technology and automation software.

The fourth industrial revolution, or Industry 4.0

In recent decades, a fourth industrial revolution has emerged, known as Industry 4.0. It emphasizes the digital technology of recent decades and takes it to a whole new level with the help of interconnectivity through the Internet of Things (IoT), access to real-time data. and the introduction of cyber-physical systems.

Industry 4.0 offers a more comprehensive, interrelated and holistic approach to manufacturing. It connects the physical with the digital and allows better collaboration and access for all departments, partners, suppliers, products and people, as seen in figure 1. Industry 4.0 empowers business owners to better control and understand each aspect of their operation and enables them to leverage instant data to increase productivity, improve processes and drive growth.
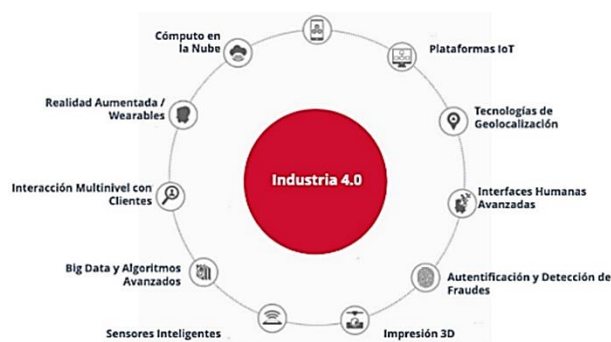
Figure 1 Elements of Industry 4.0

Description of activities

In this project, a proposal will be made to each student assigned to stay to implement a study of Industry 4.0. Once prepared, he will be able to choose a business proposal to study its origin, its business line and its natural development of the process. Thus, you will implement a case study where you can implement an improvement in your distribution line, either in the plant or in your area of logistics, production, quality, distribution, sale, shipment or any department that requires it according to your perspective.

To do this, they will be given a choice between a manufacturing industry, Food or beverage area, etc., and in this search period it is planned that the solver is involved in the development process of this industry, carry out a study of potential development market and implement one of the solutions that can be improved or, at the same time, promoted from your analysis perspective according to the twelve points suggested in the previous research of this project.

TELLEZ-HERNÁNDEZ, Rubén, PÉREZ-VILLEGAS, Manuel, TENORIO-CRUZ, Fermín and JUÁREZ-CORTES, Erik. Challenges and perspectives for the implementation of Industry 4.0 in the Mexican industrial sector. Journal of Business Development Strategies. 2020

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Choosing an Industrial plant

A case example of the Bimbo plant was taken due to its business line; A transnational Femsa Coca Cola was chosen and a beverage and beer industry was chosen, given the proximity to the regional sector. In this, its origin of distribution market, history and a study of several characteristics that will be mentioned will be investigated.

The differences of the companies with IoT solutions will be potentiated, with a TSU professional trained and qualified to generate Industry 4.0 solutions, with diverse minds and fresh ideas with development to improve their environment, in order to give a guideline to encourage entrepreneurs to invest in switch to Industry 4.0.

Figure 2 New organization charts 4.0
Source: (www.iproup.com)

Study of the company process

The most appropriate thing is to surf the internet and obtain the closest thing to your reality with everything related to the company to study, either on YouTube or another platform: your strategy and company functionality, to be able to study your organization chart and your possible proposals for future development and outline its needs for change and development, as well as its growth problems, which will tie it to stop its operations.

In addition to that, the professional will carry out a start questionnaire where they will ask:

Specifically, what should the person responsible for this project do at the beginning?

Conventional Organization Chart vs Industry 4.0

Figure 2 shows the new type of organization chart for 4.0 companies, with the organizational structure according to the new technologies and with the presence of the Squads,

In this model, the vision of work is transformed, flexible hours and benefits, such as "buying" extra vacation days, become more important. When it comes to engaging with internal audiences, details count more than ever.

"4.0 companies are migrating towards a flat and multidisciplinary model, based on agile methodologies. Organizational charts change their top-down structure to go to a work cell model ...

"Ordered by the result, in which the leader can change by process or project stages, the figure of the all-powerful boss changes for a more facilitating and coordinating role for the rest of the work cell," explained Juan Galo Martínez HR partner of Auren, for the iProUP medium.

Likewise, Federico Carrera, Associate Director of High Flow Consulting asserted that "by incorporating the physical and digital world, the areas that carry out each role continue to exist, but the processes and tasks changed, modifying the number of people who can integrate the area and your responsibilities".

"In addition, technology made many tasks can be done from centers of experts, regional or global, which makes an operation more efficient", concluded Martínez.

Departmental choice to implement (IoT), the What to do?

Choosing the area of performance is somewhat not due to disruption, given the interrelation of each and every department and area due to its flexibility of multitasking, but it is advisable to be an expert and master multifunctionality and multitasking departments.

Among the objectives to be met will be:

Develop processes and control and supervision systems with connection to the Internet of things through solutions that combine intelligent sensorization of production processes and generation of analytical data to support decision-making management, this to make the performance of any area of the value chain of the company that was chosen.

Conscious of enhancing productivity and increasing profits, not only those chosen, such as the manufacturing, machinery and equipment industries, but also energy, transport, commerce, franchises, etc., which are adopting said potential.

Possible scheme to treat:

- Analysis of Indicators.

- Mapping and visualization of requirements 3.- Taking and applying measures.

- Smart Sensorization with information in real time.

- Organization and data feed on the Internet.

- Expansion of its Analytical, monitoring and data prediction systems in a personalized Web platform.

Benefits to be obtained by the Company that invests in this process of Industry 4.0 change and adopts the Internet of Things in its processes:

- Motorization of production in real time.

- Improvement in times.

- Cost optimization.

- Decreased supervision.

- Efficient production planning.

- Inventory Improvement.

- Higher productivity.

- Optimization of Distribution Routes (Retail).

This is as you can invest for change. Therefore, "Industry 4.0" offers a comprehensive, interrelated and holistic manufacturing scenario.

It will empower business owners to understand, control every aspect of their operation to increase productivity, leverage instant cloud data to improve processes and drive business growth.

Results

The expected results in the implementation of the Industry 4.0 evolution model is, moreover, a summary of what we hope to obtain from a company that invested in the fundamental paradigm shift and without return. And its development is the positioning and growth, but with a technological sense to be ahead of its times, and remain in the development of society.

Technological pillars of Industry 4.0:

- **Internet of Things or Internet of Things:** Not only are computers connected to the network, but machines, devices and everyday objects offer us relevant information and data for further analysis.

- **Advanced robotics and artificial intelligence:** Machines created with the purpose of automating tasks, decision making and even learning, trying to emulate the logical thinking of the human being.

- **Systems for vertical and horizontal integration:** Each company selecting an internal implementation of a service or process (vertical) or integrating into cooperation or outsourcing mechanisms (horizontal).

- **M2M (Machine to Machine) communication:** Thanks to various technologies, machines communicate by exchanging information and can perform efficient actions without human intervention.

- **Cyber-physical systems:** With devices that incorporate both computational and storage and communication skills in order to direct and interact with a physical process.

- **Big Data:** It is the massive analysis of data, which can be processed and stored for unknowns and issues that previously would not have been possible to resolve in the company.

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Conclusions

At the end of this project proposal it is assumed that it will be an example of the solution to problems that can be seen from another perspective, which is not seen to have an improvement that simple, but with a multidisciplinary vision of ICT applied to the industry of the fourth revolution.

Each of the projects that are generated in the students will be attributed to the implementation in an integral and simultaneous way, in such a way that they consolidate the transformation of the chosen companies.

There are many challenges facing the world today, but possibly one of the most important is understanding the new industrial revolution. For the first time it can be affirmed that the fourth Industrial Revolution brings about the transformation of humanity due to the convergence of digital, physical and biological systems that lead it.

New technologies are changing the way we see, work and relate to each other, and the speed, breadth and depth of this revolution forces us to rethink how countries develop, how organizations generate value and how it adapts humanity itself to evolution.

The Fourth Industrial Revolution is characterized as the key to the new technological revolution and highlights the opportunities and dilemmas it poses. New forms of collaboration can shape the fourth industrial revolution for the benefit of all. If we accept the collective responsibility to create a future in which innovation and technology serve people, we can take humanity to new levels of moral consciousness.

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Impact of the CETES interest rate and the peso-dollar exchange rate on inflation control in Mexico

Impacto de la tasa de interés CETES y el Tipo de Cambio Peso-Dólar en el control inflacionario de México

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Abstract

In Mexico, the objective of monetary policy is to maintain price stability, that is, to control inflation. Its implementation is carried out by the central bank in the financial markets. Given the great importance of monetary policy in the economy, the objective pursued in this article is to identify the influence of the independent variables: the interest rate represented by the Federal Treasury Certificates (CETES), and the Peso exchange rate. - Dollar (TCPD) in the variable inflation rate depending on the country. These variables were taken as study subjects and analyzed through their monthly numerical data in a period of time made up of the years 2013 to 2018. The method to generate results was statistical, with the use of multiple linear regression. The contribution of this research results in the establishment and verification of the relationship between the selected variables contributing to the literature in the field of study of finance.

Inflation, CETES, Exchange-rate

Resumen

En México, el objetivo de la política monetaria es mantener la estabilidad de precios, es decir, controlar la Inflation. Su implementación la realiza el banco central en los mercados financieros. Dada la gran importancia de la política monetaria en la economía, el objetivo que se persigue en este artículo es identificar la influencia de las variables independientes: la tasa de interés representada por los Certificados del Tesoro Federal (CETES), y la tasa de cambio Peso - Dólar (TCPD) en la tasa inflacionaria variable dependiente del país. Estas variables fueron tomadas como sujetos de estudio y analizadas a través de sus datos numéricos mensuales en un período de tiempo conformado por los años de 2013 a 2018. El método para generar resultados fue estadístico, con el uso de regresión lineal múltiple. La contribución de esta investigación deriva en el establecimiento y comprobación de la relación entre las variables seleccionadas aportando a la literatura en el campo de estudio de las finanzas.

Inflation, CETES, Tipo-de-Cambio

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Introduction

In the first section, the background is presented and the problems that give rise to this research are examined. Subsequently, the general objective is established and the delimitations and limitations of the study are described. In the second section, the theoretical bases of the article are developed. The third describes the methodological design that, for the purposes of this research, is considered appropriate. The fourth section describes the way in which the statistical analysis was carried out and the results obtained from it. In the fifth section, thanks are given to P / PROFEXCE for financing the article; the sixth describes the conclusions of the study and finally incorporates the references used in this article.

Background

Central banks are the authorities responsible for providing currency and implementing monetary policy, associating with it those actions used by the monetary authority and determining the conditions under which it provides the money that is circulating in the economy, where behavior influences of the short-term interest rate.

The central bank, in this case that of Mexico, is the one who sends signals to the market to affect the decisions of the agents and in this way modify the behavior of certain variables. This is how the Bank of Mexico affects the interest rate, the exchange rate, the price of the shares of companies that are listed on the stock exchange, the behavior of bank loans, aggregate demand, the expectations of economic agents, inflation, among others (Guzmán and Padilla 2008).

Monetary policy in Mexico is in charge of the Bank of Mexico (Banxico), having as its main objective the achievement of price stability, however, previous authors point out that monetary policy does not directly affect inflation, but rather it does through certain transmission mechanisms and, in our country through the signal effect; which consists of the central bank indicating the direction in which it wants the economy to lead, making known its intentions to modify interest rates.

On the other hand, exchange policy in Mexico is the responsibility of the Foreign Exchange Commission. This commission is made up of officials from both the Ministry of Finance and Public Credit and the Bank of Mexico. This refers to the set of decisions and actions that are carried out to manage the value of the national currency in relation to other world currencies, through the choice of an exchange regime.

Problem Statement

The acceleration of inflation could generate significant adverse effects, especially in the poorest population, to avoid a further deterioration in welfare it is necessary to ensure control of inflation. As of January 2017, the annual growth of the National Consumer Price Index (INPC) has registered continuous increases.

According to a survey conducted among private sector specialists collected by the Bank of Mexico, the median inflation expectations for June 2017 was only 3.2 percent. The rise in prices above forecasts has led to an almost continuous upward correction of inflation expectations for the short and medium term. For example, according to the same source, the expected inflation for the end of 2017 was 6.0 percent, more than two percentage points above the estimate six months ago.

The immediate factors that have driven inflation have been widely discussed in different forums. Among them, the direct and indirect impact of the increase in the administered prices of gasoline, as well as the exchange rate depreciation stand out.

However, contrary to what is often claimed, the rise in inflation has not been just a change in a few relative prices. In particular, more than 60 percent of the components of the INPC experience annual price increases of over 4.0 percent. The problem is that, as always, it is not known how long inflation will remain high or how much more it will rise.

The consequences of inflation cannot be underestimated, especially if it has not been anticipated. With the resulting uncertainty, individuals and companies face difficulties in making adequate decisions. Not only are price signals clouded, but planning is complicated. Perhaps the most serious cost of unexpected inflation is undesirable income redistribution. This is so because inflation operates as a hidden and tremendously unfair tax.

In general, inflation surprises benefit those who owe nominal amounts and hurt those who receive them. Among those most affected are workers whose nominal salary is fixed for at least one year. In Mexico, the greatest deterioration in real wages has been recorded when inflation has risen considerably, as in the 2008-2009 crisis. Its recovery has been very slow, after several years after the inflationary episode ended. A similar effect occurs with retired workers, especially in cases where pensions are not fully indexed to inflation.

By far the worst affected are the poor, who represent a high proportion of the population. As many of them work in the informal economy, their real income is less protected than that of the formal one. In addition, they keep most of their savings in the form of cash, which automatically loses purchasing power and immediately faces the increase in the price of food.

Finally, the costs of inflation can reduce the dynamism of economic activity. In Mexico there are signs that the fall in real wages has led to a slowdown in consumption. This highlights, once again, that the dilemma between fighting inflation and worrying about economic growth is a chimera.

In conclusion, considering that the inflationary phenomenon in Mexico will be temporary does not allow us to minimize its impact. The adverse consequences for the most vulnerable population, who live with very limited resources, can be very serious. Continuously fighting inflation must remain a social priority.

Research question

Is there an influence of the interest rate (CETES) and the Exchange Rate (Peso - Dollar) in the inflationary behavior of our country?

Objective

Check the influence of the interest rate (CETES) and the Exchange Rate (Peso - Dollar) on the inflationary behavior of Mexico, through the use of statistical tools, in order to broaden the spectrum of information regarding the variables of investigation.

Justification

It is important to understand the phenomenon of inflation, which distinguishes between generalized price increases, which occur once and for all, in those price increases that are persistent over time.

The importance of studying and maintaining low and stable inflation is to maintain sustained growth without considerable fluctuations where people can consume. It can also be analyzed to make a distinction regarding the degree of increase. There are countries where inflation is controlled below 10% per year, others with average inflation that does not exceed 20% per year, and countries where sustained price growth has exceeded 100% per year.

That is why in the countries different policies are established that help to adjust the inflation rate, where these policies can be studied for knowledge and understanding of their behavior, both in increases and decreases within the market that affect economically among other aspects. When increasing interest rates reduces loans and slows consumption, the demand for products is lower, leading to economic stagnation and unemployment within the country.

This research is considered pertinent, since, in carrying out its objective, it will contribute to the literature focused on the analysis of the factors that influence inflation in a country, giving greater understanding to readers who have a minimum amount of information and that, due to its degree of complexity, it is difficult for them to understand the subject clearly.

It is important for the inhabitants of a country to know how the Bank of Mexico cares about its stability through the control of price increases, and how it uses different variables as instruments for this.

Limitations

The research considers two independent variables chosen through the analysis of various studies, and other variables that affect the phenomenon may remain for possible future research.

In addition, it is necessary to emphasize that the data analysis will consider a specific time period, from 2013 to 2018, where the numerical behaviors of the variables will be taken.

Theoretical framework

Over the years, different theories have emerged that are based on monetary policy and its behavior. Rodríguez (2005) explains the existence of theories that are based on monetarism, such as those of Fisher and Milton Friedman, being recognized as the two most important monetarist economists of the 20th century. Fisher explains that the rises and falls in prices correspond to the rises and falls of the money supply.

A cause other than the rise in prices occurs with the issuance of paper money, which produces violent variations in the quantity of money and generally followed by violent variations in the price level. When this arises, Humé's classical approach is that the prices of commodities are always proportional to the quantity of money; this was strengthened in the nineteenth century with the studies made by Ricardo on the circulating paper money and prices in England. (Rodríguez 2005).

The quantity theory of money formulated by Hume since 1568 is known as an economic theory of determining the price level. Establishing in it a direct relationship with the amount of money and the general price level.

Following this formulation, Fisher's theory occurs in 1911. Fisher has a mathematical equation in which he relates real interest rates, nominal interest rate, and inflation. Saying that the real interest rate is equal to the nominal interest rate minus the level of inflation, this adapts to the fact that the real interest rate will always take into account the level of inflation that exists in the country. Relating to a large extent this theory to the variables that will be measured in this analysis.

Milton Friedman with the new formulation of the quantitative theory refers to the fact that a stable money supply determines a stable price level, if the supply is increasing prices also increase. In this way linking the classical theory of Hume with the modern of Fisher. (Rodríguez, 2005).

Aragón and Velandia (2010), on the other hand, agreeing with the previous theories, discuss in their article that the monetary authority has the ability to modify the expectations of agents about the path of future inflation, and will also be able to affect the interest rate trajectory at different time intervals. Basing this argument on the Fisher 1930 equation which is based on the fact that interest rates can be expressed as the sum of the real interest rate and inflation expectations during the asset holding period.

These authors describe in a very simple way, the monetary policy transmission channel better known as the "interest rate channel", citing Miskhin (1995). However, this channel is not the only one that the monetary authorities expect before the application of policy measures, recognizing the existence of other channels such as asset prices and the exchange rate are also activated with policy actions for a better control of the same monetary policy.

Agreeing with the above, it is understood that if the monetary authority manages to modify interest rates, it would affect the agents' consumption and investment decisions by changing their opportunity cost. In the same way, Juárez and Vidal (2010) describe the Fisher effect to base the analysis of the change in inflation having its origin in the growth of the quantity of money, which translates into a variation of the nominal interest rate in identical proportion. This contribution generates more confidence in this study because it explains how a change in inflation lies in the growth of money that translates into variations in the interest rate, which would be the target interest rate.

In their study they conclude that there is a correlation between monetary policy, interest rates and inflation. And there is an interaction between the agents that control these variables, such as central banks and policy leaders, without neglecting the private sector that influences this sequential game via expectations.

In the previous paragraphs it is shown how a central bank exercises inflationary control through the actions of monetary policy from the point of view of different authors and studies they have carried out. The monetary policy instruments that are implemented for the best performance are described below.

Monetary policy instruments comprise the "set of appropriate monetary policy procedures used by central banks capable of influencing the economy (more or less expansionary or restrictive)" (García, S / F). Morales (2000), in his article argues that the existence of a government securities market is essential for the central bank and thus the bank carries out the purchases and sales of securities, that is, open market operations.

Aragón and Velandia (2010) mention that open market operations constitute the main instrument of monetary policy that is used by the federal reserve. And therefore these operations have an effect on inflation control, the main focus of said policy.

Obtaining that the purchase and sale of treasury securities determines the federal funds rate (interest rate at which depository institutions lend the balances they maintain in the federal reserve to other institutions). Therefore, according to these authors, the federal funds rate is the rate that affects the monetary and financial conditions of the economy.

In this context, the public debt instruments that the government issues as control to the economy arise through an auction of risk-free securities, which is why the CETES are used as an instrument to control monetary policy, they are the instrument of Oldest stock debt issued by the Federal Government. They were issued for the first time in January 1978 and since then they constitute a fundamental pillar in the development of the money market in Mexico (Banco de México, 1999).

García (1988) mentions that the CETES offer high returns and high liquidity to investors, which makes them the leading instrument in the financial market; He comments that this quality allows the federal government to use this instrument as a means of financing to attract resources, that is, as a means of obtaining public credit and, in addition, as an instrument for the control of the money supply.

In this case, the same author explains that, if the government seeks to reduce cash to lower inflation or modify the expectations of current interest rates, it can be done through the CETES, considering the difference between the amount that is being amortizing or that is being collected and the new amount issued, which is the amount that will be affecting the circulating medium. The CETE is used as a reference rate by the government to control monetary policy and thus stabilize the economy.

Therefore, the government with the use of this instrument wishes to maintain a better behavior in inflation, to help monetary policy to control the variations in these rates in the market. On the other hand, the Legal Reserve was used as an instrument and represented the part of the computable liability of the commercial banks that obligatorily deposited in the Central Bank to constitute a monetary reserve.

It was the monetary reserve that commercial banks used in case of not having liquidity. The Central Bank used it to cover the financing of state companies or to balance the budget deficit for public spending. The legal reserve was replaced by the liquidity coefficient, today there are none of them (Balderas, 2011).

Due to the fact that none of the aforementioned instruments are in use today, currently the instruments that Banco de México has used to sterilize large amounts of long-term liquidity are the Monetary Regulation Deposits (DRM). DRMs are mandatory long-term deposits that national credit institutions have to establish at the central institute. (Banxico, S / F).

Once the main concepts of monetary policy and its instruments have been defined, some articles are described as a literature review.

According to García 2018, it refers to the research by Roley and Sellon (1995) who conducted a study on the role of expectations in determining interest rates on government securities in the United States, concluding that the influence of expected interest rates in the determination of rates, it increases as the maturity period of the bonds is longer.

Cuenca, Amaya and Castrillón (2015) discuss the endogeity of the money supply referring to Fuentes, Marrero and Herrera who in most macroeconomic books affirm that when considering that the monetary authorities can exercise strict control over the amount of money in circulation, is how the money supply is usually represented as a vertical straight function with respect to the interest rate.

In order to analyze these theories, Cuenca et al (2015) citing Fernández, Rodríguez, Parejo, Bernardino and Galindo (2003) showed the Taylor rule (1993) which for the United States revealed that the conduct of monetary policy by The Federal Reserve could be simplified into a rule for the federal funds interest rate in which this rate responded positively to inflationary shocks and to output shocks.

Based on this rule, it is predicted that the interest rate r should increase if inflation is above a 2% target or if real output deviates from its trend. Based on the Taylor approach and the formulation of the policy rule, the Taylor principle is defined as the search, by the central bank, to significantly disrupt the real interest rate in order to bring inflation closer to its target.

Taylor establishes that the only firm monetary policy option would be based on the trinity of a flexible exchange rate, an inflation target, and a monetary policy rule. That, coinciding with the Taylor contributions, this analysis study is precisely that same trinity, because the variable CETES interest rate acts as a monetary policy rule, the exchange rate (Peso - Dollar) that is currently flexible in the country, and finally analyze the inflationary behavior of prices in the country.

On the other hand, this work seeks to analyze whether monetary policy with the use of CETES maintains influence on the rise in prices. But, in addition, as the Bank of Mexico (S / F) also indicates that exchange rate policy is another way to control the flow of money in Mexico and therefore inflation, as the central bank states are a set of decisions and actions that They are carried out to manage the value of the currency, in relation to others in the world. This policy in Mexico is the responsibility of the foreign exchange commission, which is made up of officials from the Ministry of Finance and Public Credit and the Bank of Mexico.

Within this exchange policy is the theory of purchasing power parity (PPP) which, according to Medina and Noriega (2001), acts as an economic indicator that is proportional to the real exchange rate. The concept of Purchasing Power Parity (PPA) is attributed to Gustavo Cassel, who formulated it in the 1920s. It is mainly based on the Law of the Single Price, which says that a good must be sold at the same price in any two countries that trade said good if there are no impediments to international trade, if there are no capital flows and both countries operate in full job.

In order to be comparable, the price of the good in each country must be valued in the same currency. That is, assuming also homogeneous goods, the price of a good in the United States, for example, must be equal to the price of that good in Mexico (in Mexican pesos) multiplied by the nominal exchange rate (where the exchange rate is defined as the domestic currency price of a unit of foreign currency).

In this area, different researchers have studied the behavior of the exchange rate as one of the variables influencing inflation through the following studies.

Guzmán and Padilla (2008) mention that within a flexible exchange rate, monetary policy becomes exogenous because its activity is determined by external values, whereas the exchange rate becomes an endogenous variable as it can be controlled by the variations in the same market.

Due to the fact that within an open economy with a flexible exchange rate regime such as that currently used in Mexico, and with capital mobility, an expansive monetary policy translates into an increase in the demand for goods and services, generating pressure on domestic prices (inflation) and an increase in imports. As the exchange rate is flexible, the demand for foreign currency for imports generates a depreciation of the exchange rate.

Reviewing the literature of other authors in similar studies, Guzmán and Padilla (2008) citing Bravo and García (2002), who conducted a study of the impact of monetary policy on output, inflation, and the real exchange rate in Chile with monthly data from January 1986 to December 2001. Obtaining as results that the effect on the exchange rate is a permanent appreciation in the first months, but then tends to vanish.

Analyzing the exchange rate is important due to the high volatility that it exposes in its values, Nájera and Gutiérrez (2012) citing Banxico (2008) mention an example, in September 2008 the Mexican peso against the US dollar shows high volatility, when It was quoted at $ 10.9814 pesos per dollar, which represents a devaluation of 6.77% compared to the previous month, in December it increased to 14.3097 pesos, reaching 15.365 pesos per dollar on March 3, 2009, with a devaluation of 40.52% with respect to the same month of the previous year.

Reyes, Muñoz and Moslares (2004) point out that the exchange rate policy in Mexico has been used as an inflationary anchor, since the overvaluation of the peso directly exerts downward pressure on prices.

Referring to Gaytán and González (2006), they try to identify changes in the transmission mechanisms of monetary policy in Mexico with monthly data from November 1991 to February 2005. The variables they use are the real exchange rate, inflation, inflation expectations and the nominal exchange rate.

García (2013), believes in his study focused on the determinants of inflation that previous experience has confirmed that to obtain higher levels of investment and economic growth, as well as better living standards, it is necessary to have an environment of stability of prices that allow economic planning and maintain the value of money over time. That is why the great importance that with the correct use of monetary policy instruments, price stability can be achieved that will achieve considerable benefits to the economy.

However, the Bank of Mexico as an institution cannot directly influence the prices of all goods and services in the economy, therefore, in order to meet these objectives, it looks for economic variables on which it can directly influence and which are related to other variables that impact on economic activity and consequently on inflation and the exchange rate. (Bank of Mexico, 2020).

In closing, the selection of price stability as the priority or sole objective is justified by empirical evidence, which has shown that monetary policy is relatively more effective in controlling inflation than in promoting economic growth (Bianchi, 1994). Since low and stable inflation is a necessary condition for achieving growth in employment and economic activity and the means by which the central bank contributes to the welfare of maintaining low inflation. (Vergara, 1998).

Next, Graphic 1 shows the behavior of the inflation rate in the country in a period of 6 years:

Graphic 1 Percentage of inflation (2013 - 2018)
Source: Own elaboration with data from INEGI. (2013-2018)

With the study of these data, it is perceived that inflation has maintained a behavior that has not been stable, but nevertheless does not present increases with valleys or peaks, which are too visible, it could be inferred that the Bank of Mexico by using its politics is doing its job well.

Lora (2010), mentions that the country goes through different problems, which are controlled through monetary policy and exchange rate policy since high rates of inflation, deep recessions, massive devaluations in currencies occur: all these were frequent phenomena that occurred in Latin America until the early 2000s, which could reappear if monetary, financial and fiscal policies are not managed properly. Therefore, the reduction of inflation has been considered the great achievement of monetary policies in Latin America.

This is why we seek to analyze that both the monetary policy, through the CETES instruments, and the exchange policy through the variations of the exchange rate (peso - dollar) impact inflation.

Methodology

Design of the investigation

- Quantitative; because it includes numerical and statistical data from databases.

- Not experimental; since the behavior of the variables in a certain time will be analyzed, as well as the relationship that occurs between a set of variables.

- Longitudinal design; because trend data and its evolution over time will be examined, as well as the relationship between various categories or variables over time.

Subjects

The objects of study in this research are the behavior of the CETE rate from 2013 to 2018, as well as the exchange rate from 2013 to 2018 as independent variables, to explain the behavior of the inflation rate from 2013 to 2018 as a dependent variable.

Sample

The sample is non-probabilistic because data is selected, and the cases are not statistically representative through the population.

In this regard, the main bias is that the sample is not representative by not considering other variables that affect the variable under study, in addition to this, there is the factor that produces the systemic risk, specifically, in the period of time analyzed, the possibility of a faster normalization process of monetary policy in the United States and the intensification of the implementation of barriers to world trade, which have an uncertain effect on the future behavior of the Peso-Dollar Exchange Rate.

Instruments or materials

The instruments used are databases, made through data series of the historical behavior of the variables, through the use of official pages such as the Bank of Mexico and INEGI.

Regarding the amount of data selected, this research proposes a short-term model, taking into account the beginning and end of a presidential term, or, from another point of view, the end of two six-year terms: 2006-2012. and 2012-2018.

The variables were found with different measures, X1 (CETES28) in percentage, X2 (TCPD) (Peso-Dollar Exchange Rate) in pesos and Y1 (Inflation) in percentage. It was not necessary to modify its measurement since the software used for the use of linear regression only considers the standard deviations of each of the variables. Therefore, the data is added in its natural form to SPSS.

The multiple regression method was used to measure the variables, using the SPSS Statistics tool version 21.0.

Process

- Statistical data search.

- Build the database in Excel 2013 based on the information consulted in the Bank of Mexico and INEGI.

- Statistical analysis of the data through multiple regression in SPSS Statistics version 21.0.

- Determine if there is a relationship between the variables analyzed.

- Discussion of the results obtained comparing with what other authors have found in this regard.

- Draw study conclusions.

Results

The possible expected results are presented in Table 1.

↑	CETES28	↑	Inflation
↓	CETES28	↓	Inflation
↑	CETES28	↓	Inflation
↓	CETES28	↑	Inflation
↑	TCPD	↑	Inflation
↓	TCPD	↓	Inflation
↑	TCPD	↓	Inflation
↓	TCPD	↑	Inflation
Note: Up arrows indicate bullish behaviors, down arrows represent bearish behaviors			

Table 1 Possible expected results
Source: Own elaboration (2020)

Next, the multiple linear regression analysis was carried out in order to identify or discard independent variables in the model, generating the following results.

The correlation coefficient shows the degree of relationship or association between the study variables. The degree of linear relationship can range from a perfect negative correlation of -1.0 to a perfect positive correlation of +1.0. The magnitude of the relationship is indicated by the absolute value of the correlation coefficient where, the higher the magnitude of the correlation, the stronger the relationship between the variables.

In order to determine the existing correlation between the variables proposed in the model, Table 2 is presented, where it is observed that the variable most related to Inflation is CETES28 with a correlation of 0.739, on the other hand, TCPD shows a Pearson's correlation result of 0.275 with the Inflation variable.

		Inflation	TCPD	CETES28
Pearson's correlation	Inflation	1.00	0.275	0.739
	TCPD	0.275	1.00	0.719
	CETES 28	0.739	0.719	1.00
Sig. (One-sided)	Inflation	.	0.01	0.000
	TCPD	0.01	.	0.000
	CETES 28	0.000	0.000	.
Note: The correlation is significant at the 0.05 level (bilateral) Dependent variable: Inflation. Predictor variables: (Constants), CETES28, TCPD				

Table 2 Correlations
Source: Own elaboration (2019), with data obtained from SPSS 21

According to Table 3, the corrected R squared of the model indicates that it has a predictive capacity of .637, in this sense Hair (2006) refers that the predictive power of the model is moderate. The Durbin-Watson test can also be observed for serially correlated residuals. This statistic ranges between 0 and 4 and takes the value 2 when the residuals are completely independent. Values greater than 2 indicate positive autocorrelation and values less than 2 negative autocorrelation. The residuals are usually assumed to be independent if the D-W statistic is between 1.5 and 2.5. The value obtained for said test was .314

In this same Table 3, it is shown that the ANOVA of the resulting model is statistically significant based on the value obtained in the column Sig., Where the result is less than 0.05, the value of F greater than 2.4. The null hypothesis that the variability observed in the response variable is explained by chance is rejected and it is admitted that there is some type of association between the dependent variable and the independent variables. Therefore, the model is relevant.

In order to determine if there is collinearity, two procedures were used: 1.) The empirical rule, cited by Kleinbaum, Kupper, and Muller (1988), which consists in considering that there are collinearity problems if any IVF is greater than 10. In Table 3, it can be seen that the value obtained is less than 10. 2). For Belsley (1991), condition indices between 5 and 10 are associated with weak collinearity, while condition indices between 30 and 100 indicate moderate to strong collinearity. As can be seen in the results, the "Condition Index" in the model is less than 30, so it can be stated that there is no multicollinearity problem.

Variables selected in the model	
Predictors	CETES28, TCPD
Dependent variable	Inflation
R Square corrected	.637
Durbin watson	.314
ANOVA	Sig. 0.000
F	73.991
IVF	2.067
Condition index	18.696

Table 3 Statistical results
Source: Own elaboration (2019), with data obtained from SPSS 21

Continuing with the statistical analysis, with the aim of observing the behavior of the variables, the significance of the less than .005 and the signs obtained in the standardized coefficients was used as a reference.

Based on the results obtained, shown in Table 4, according to the significance of the β, it is observed:

- There is a causal-correlation relationship between the dependent variable Inflation and the independent variables CETES28 and TCPD.

- CETES28 has a positive impact on Inflation, that is, the higher the CETES28 interest rate, the higher the Inflation; while TCPD had a negative impact on Inflation, so that when the exchange rate behaved upward, the level of Inflation decreased, this occurred in the time interval analyzed.

Table 4. Behavior of

	Significance of the Beta ()	Typified coefficients ()
CETES28	.000	1.12
TCPD	.000	-.053

Source: Own elaboration (2019), with data obtained from SPSS 21.

Acknowledgments

Conclusions

In this study, it was verified how movements in the CETES28 rate maintain a positive correlation with movements in the Inflation rate; conversely, the movements of the TCPD were presented.

As a result of this research, Fisher's theory is verified, which establishes that the rise and fall of prices correspond to the rise and fall of the money supply. This is manifested in the results obtained, by showing that the CETES28, which functions as a control mechanism for the money supply, maintains a positive and high correlation with Inflation.

The authors Juárez and Vidal (2010) affirm that a change in inflation causes greater circulation of money and this induces variations in the target interest rate. In the same way, García (1988) in his study expressed that if the government seeks to reduce cash and thus reduce inflation or modify interest rate expectations, it can do so using the CETES28.

In addition, it is established that there is an important relationship between Inflation and the interest rate, coinciding with Gutiérrez and Zarita (2006), who assert that interest rates compensate lenders for the risks of Inflation. As an example, they show that, if the expected Inflation rate is at 5%, the nominal interest rates will have to behave by at least that percentage to compensate for the expected loss of purchasing power due to Inflation. Serving as a measure of safety margin in nominal interest rates. So the higher the Inflation, the more the current interest rate will increase.

On the other hand, speaking of exchange rate policy, in this study a precedent was generated in the use of the exchange rate with Inflation, which has an inverse impact, that is, in the years analyzed 2013 - 2018 while the type of The exchange rate rose (the value of the dollar, relative to the peso), inflation decreased, and while the exchange rate decreased, inflation increased. It is important to remember that the dollar was measured against the peso and if the dollar appreciates, the peso depreciates or vice versa. This confirms that the value of the peso, speaking of increases or decreases, remained in the same line as the other variables, as revealed by the study.

Which tells us that, as the value of the dollar rose, the peso depreciated, inflation decreased, or vice versa. Perhaps this is a test of the theory of purchasing power, that is, if the value of our currency (peso) (compared to the dollar) is low, the country should maintain a low level of Inflation, or if the value of our currency This high, Inflation behaves upward, having better purchasing power.

The results lead to compliance with the law of the single price, giving observance to purchasing power parity, since the theory says, you cannot sell the same good at a different price in a different place, because it causes arbitrage. So a dollar or any currency must have the same purchasing power in the country that is handled. In this case, when the exchange rate or the currency of the United States fell, the inflation rate rose, but the peso improved in value, causing the peso to perform the same.

A result very similar to that of this research, when having inverse behaviors in the exchange rate and Inflation, was presented by Guzmán and Padilla (2008) who mention that Mexico is part of an open economy with a flexible exchange rate and by generating an increase in demand for goods arises Inflation. This leads to an increase in imports and causes a depreciation in the exchange rate, which is what happens in the time interval analyzed in this project. In the same way, Reyes, Muños and Moslares (2004) showed that the exchange rate and price behavior (Inflation) present a close correlation during the years 1990 to 2002.

Finally, as established in the conclusions of the Banda, Gómez and Almaraz study (2020), the interest rate and the exchange parity are fundamental factors for carrying out expansion and growth plans by companies of all markets. sectors, whether service or manufacturing, especially if they do not have sufficient liquidity to support capital investments. When there are shifts in the peso against the dollar, uncertainty about the recovery of investment increases, so generally businessmen in times of high inflation and devaluation decide not to invest, thereby slowing down the country's growth, job creation, exchange rate parity and general terms economic stability of the country.

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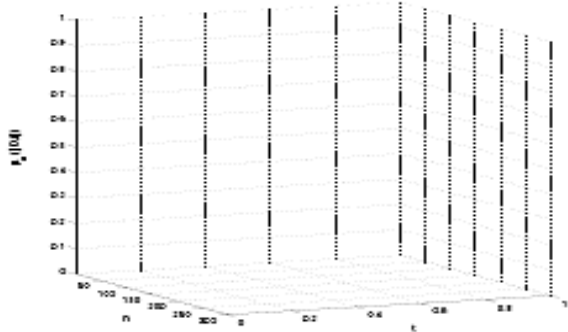
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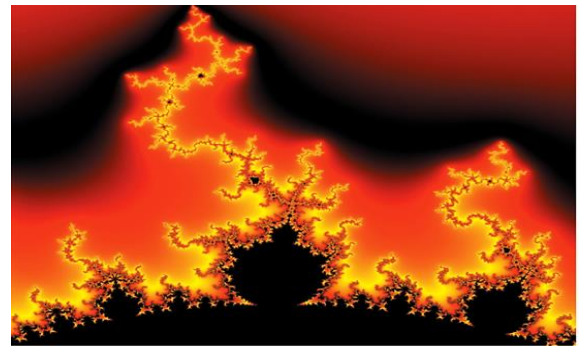
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