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Presentation of the content

In the first article we present *Graphic interface design as support for decision-making in the salt production proces*s, by Vega-Telles, Ernesto Alonso, Bueno- Solano, Alfredo, Acosta-Quintana, María Paz Guadalupe and Suastegui-Ramos, Francisco, with adscription in the Instituto Tecnológico de Sonora, in the next article we present *Financial education and its relationship with eighth-quarter students of the bachelor's degree in business innovation at a university in Cancun*, by López-Cetina, Yamit, Preza-Medina, Sergio Roberto, Hernández-Chacón, Sandra and Chan-Ac, Irving Arlin, with adscription in the Universidad Tecnológica de Cancún, in the next article we present *Perception and use of public space in Puerto Vallarta. A comparative analysis between men and women*, by Pérez-Ramos, Sara Paola & Posadas-Torres, Daniella Alessandra, with adscription in the Universidad de Guadalajara, in the next article we present *The relationship that exists between market analysis and sales management carried out by microentrepreneurs in Santa Cruz de Juventino Rosas, Gto*, by Valdez-González, María Isabel, Cano-Ramírez, Eliseo and González-Escoto, Claudia, in the next article we present *A strategy to enhance decisions in logistics and transportation companies*, by Castro-Benítez, José Luis & Hernández-Maldonado, Victor Miguel, with adscription in the INFOTEC, in the next article we present *Classroom sanitizing robot*, by González-Monzón, Ana Lilia, Rivera-Enriquez, Yuli Guadalupe and Sánchez-Gamboa, Diana Isaura, with adscription in the Tecnológico de Estudios Superiores de Jilotepec.

Content

Journal Economic Systems 8[14]1-11: e10814111
Article

Graphic interface design as support for decision-making in the salt production process

Diseño de interfaz gráfica como apoyo para la toma de decisiones en el proceso de producción de sal

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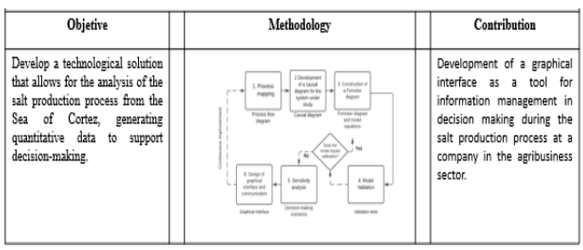
Abstract

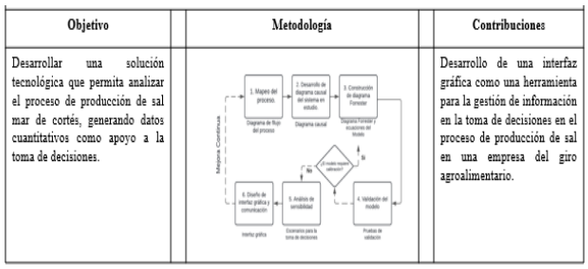
El Desarrollo del presente proyecto, se centra en el disseño de una interfaz gráfica como herramienta para la gestión de información en la toma de decisiones en el proceso de producción de sale en una empresa del giro agroalimentario en la region Sur del estado de Sonora, México. Siendo esto posible por medio de la aplicación de metodología de dinamica de sistemas con el fin de evaluar las relaciones e interacciones de los elementos presentes en el sistema bajo estudio, determinando con ello las variables y parámetros sensibles comprometidos en la producción y comercialización de sal de consumo humano.



Smart Farms, Dynamical Systems, Graphic interface

Resumen

The development of this project focuses on designing a graphical interface as a tool for information management in decision making during the salt production process at a company in the agribusiness sector in the southern region of Sonora, Mexico. This is made possible through the application of systems dynamics methodology to evaluate the relationships and interactions of the elements present in the system under study, thereby determining the sensitive variables and parameters involved in the production and commercialization of human consumption salt.



Agroindustria, Dinámica de Sistemas, Interfaz gráfica

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Introduction

The production and marketing of salt plays a fundamental role in the global economy, given its widespread use in key industries such as food, chemicals and de-icing. This mineral is not only essential for human life, but also constitutes a crucial input for the manufacture of chemical products, food preservation and the maintenance of road infrastructure in cold climates. Leading salt-producing countries, such as China and the United States, have a significant influence on global markets, impacting salt prices and availability worldwide. In addition, international salt trade reflects economic interdependencies between nations. A notable example is Mexico, which imports large volumes of industrial salt mainly from the United States, highlighting the importance of foreign trade in securing the supply of this essential resource.

Background

During 2023, world salt production reached approximately 273.8 million metric tons. China consolidated its position as the main producer with 53 million tons, representing almost 20% of global production. Together with the United States, which produced 42 million tons, both countries accounted for 35% of world production. Although the United States was historically the largest producer, in 2019 it was surpassed by China, which produced 60 million tons, compared to the 42 million tons of the United States (Gaitán, 2024).

Meanwhile, the national production of salt, in 2019, was 8.8 million tons, with an annual growth rate of 1.7% for the period 2009-2019. It is estimated that 78% of the national production is generated by the main salt company in the country, located in Guerrero Negro, Baja California Sur, whose market is purely for export; the remaining 22% corresponds to the other salt companies, which basically supply the domestic market. The location of this activity is established in the primary sources of sodium chloride, which means that 96% of production for the domestic market is concentrated in the states of Veracruz (49%), Yucatán (28%), Sonora (10%), and Nuevo León (9%) (Secretaría De Economía, 2022).

Likewise, during the year 2023, the volume of salt production in Mexico was around 757,460 metric tons, which represents an increase of almost 23% compared to what was reported during the same month of the previous year (Statista Research Department, 2023).

On the other hand, in 2023, salt production in Sonora, remained a significant part of the salt industry in Mexico with 2.4% of national production. At the national level, the state of Baja California Sur, in particular, continues to be an important salt producer in the country. Production in this region is fundamental for the supply of salt both nationally and internationally. (Opportimes, R., 2023).

Salt has diversified commercial applications. More than 80% of global production is destined for four main markets: chlor-alkali production, synthetic soda ash manufacture, road de-icing and the food sector. These uses dominate the market, with the chemical and food industries leading demand, especially in industrialized regions such as the T-MEC bloc and Europe. In addition to these sectors, other important markets for salt include water treatment and the production of chemicals such as sodium chlorate. Salt consumption varies considerably at the regional and national level, influenced by factors such as the size of the local chemical sector, climatic conditions and population density (DOF, 2021).

The company under study belongs to the agribusiness sector, being a Mexican company that processes salt produced by evaporation in the salt mines where the organization operates, with a presence of more than 30 years in the market, where the company seeks to be a leader in the production, processing and marketing of sea salt. In turn, the organization processes different types of salt according to the requirements of consumers, which vary according to their type for human, animal, and industrial consumption, among others. However, for the purposes of this research, the product under study is focused on human consumption of food origin.

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For this, the organization faces a significant challenge in the variability of demand, which affects both the production and marketing capacity of this, where in periods of high demand, the inventory is often insufficient to meet it, revealing bottlenecks in the production process. These bottlenecks hinder the efficient production and marketing of salt, compromising the plant's capacity to meet market demands, which in turn determines that the lack of an adequate methodology to identify and visualize these bottlenecks makes it difficult to make decisions aimed at optimizing the process.

It is crucial to develop a systematic approach to simulate the plant process and generate a graphical representation of the production and marketing capacity. This will facilitate the identification and solution of bottlenecks in the process, improving the operational efficiency of the company. Taking the problem as a reference, the following research question is posed: How can a technological solution based on quantitative data help to identify and visualize bottlenecks in the production process of Sea of Cortez salt? Therefore, the following objective was proposed: To develop a technological solution that allows to analyze the production process of Sea of Cortez salt, generating quantitative data to support decision making.

Methodology

As can be seen in the previous figure, the methodology is based on the study of the dynamics of systems and continuous improvement, being this element what favors the interaction between each of the elements that contemplates it, this because it considers verification steps and with it the improvement of these according to the results obtained in each of the steps that conform it, from the mapping of the process under study to the design of the interface and its implementation for decision making, in turn in the lower part of the box of the activity is listed the main result obtained in each phase of the procedure.

The first step consists of mapping the process, identifying the elements that make up the system under study, as well as the relationship that exists between them, thereby identifying the main variables, parameters and constraints.

All this is possible through the implementation of various tools that allow the conceptualization of the system, such as the use of flow diagrams and process mapping.

Subsequently, once the system has been mapped and the elements that comprise it (variables and parameters) have been identified, a causality diagram is developed in order to visualize the relationships and feedbacks between the different variables of the system. In turn, it allows understanding how the variables influence each other through positive and negative feedback loops.

Starting from the causal diagram, flow and level diagrams are generated which allows translating the qualitative description into a mathematical model in order to simulate the real system, which includes the creation of differential equations, establishment of parameters and collection of data necessary for its simulation. Where the level variables represent the accumulation of resource during the system during a defined time interval, (Orlandoni and Ramoni, 2018). For the purposes of the development of the causal diagram, the level variables are represented by stocks, rows, bands and furnaces (processes).

While, with regard to the flow variables, these are the ones that maintain the equilibrium and operation of the system, since through them the level variables present in the system are fed, representing the input and output of materials or products over time.

Once the Forrester diagram has been constructed, it is necessary to verify the correct functionality of the model under study, for which it is necessary to simulate it and submit it to various validation tests in order to verify that it is reliable according to the results obtained, where in case it does not represent real data of the current situation, it is calibrated in order to be improved and obtain a reliable model that is in line with reality and thus allows generating quantitative data to make the decision-making process more efficient.

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Considering that the model is reliable, it is immersed in different scenarios such as optimistic scenarios where modifications are made to the parameters present in the model in favor of it and thus generate advantageous information for the organization, representing an ideal state for decision making, while otherwise in the pessimistic scenario, the modifications to the parameters represent unfavorable situations. Finally, in the implementation phase, we proceed to the construction of the graphical interface, through which the user interacts with the system and thus generates quantitative data for further analysis and timely decision making in the short, medium or long term as required, such as production scheduling, overtime, outsourcing or investment in machinery and equipment, among others as appropriate.

Box 1

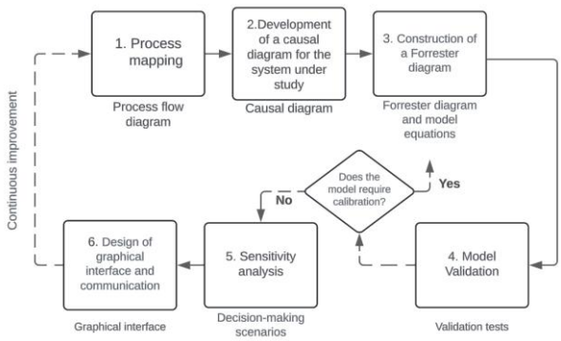

Figure 1
Methodology under study
Source [Own elaboration, (2024)]

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Results

Mapping of the process under study

In relation to the mapping of the process under study, a flow diagram was developed in which each of the processes involved in the manufacture of salt is identified, from the reception of raw material (raw salt) to the storage of the finished product (salt pallets), passing through the iodizing, packaging and palletizing process. Figure 2 below shows the representation of the aforementioned process.

Box 2

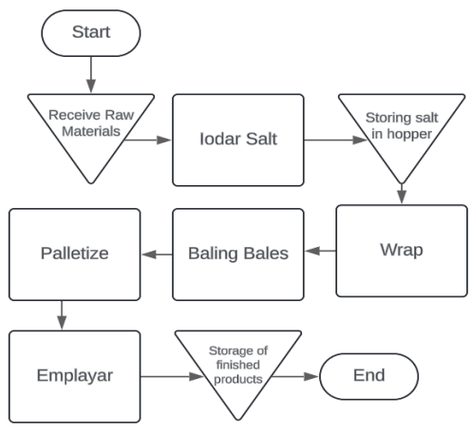

Figure 2

Flow diagram of the production process of Sea of Cortez salt.

Source [Own elaboration, (2024)]

The above flow chart shows that the process begins with the reception of raw material (raw salt), which is subjected to the iodization process as a required treatment for human consumption. Once the salt is iodized, it is stored in a hopper that supplies the product to two fillers that pack the salt in individual one-kilogram bags, to later form bales of salt and thus assemble pallets for marketing to domestic and international markets.

In addition to the development of the flow diagram, quantitative information was collected on each of the elements of the process, emphasizing data associated with production capacity and processing time. This information is shown visually in the map in Figure 3.

Box 3

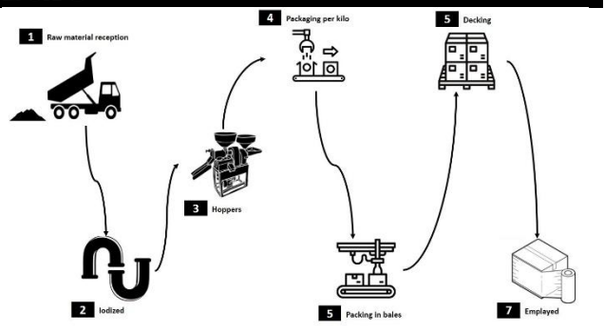

Figure 3

Mapping of the production process of Sea of Cortez salt.

Source [Own elaboration, (2024)]

In the previous map, each of the processes involved in the production of Sea of Cortez salt is graphically represented, where at first there is the reception of raw material, in which raw salt is received from the saltworks, and this is deposited in the yard of the organization, to be subsequently processed at a rate of 34 tons per shift being entered into the transformation process through a reception hopper which doses the product to pass it to the iodized process, This process consists of adding iodine to the raw salt by means of electronic devices in an elevator tube, thus generating iodized salt (product in process), which is sent to the hopper that supplies the packaging process by means of filling lines, which pack at a rate of one kilogram bag.

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The bags then go to the baling process, which consists of grouping 12 kilograms of salt, and finally being palletized at a rate of 125 bales per pallet, this being possible through the wrapping process, which lasts 2.27 minutes per pallet. Finally, the finished product is stored in the finished product warehouse, ready for marketing.

As a final part of the first step of the procedure, the variables and parameters present in the system are identified, the main variables being the amount of raw salt received by the organization and the demand for the finished product, while the parameters define the capacity and times for the reception of raw material, packaging, palletizing and wrapping.

Development of the causal diagram in the study

The causal diagram shows the variables present in the system under study and at the same time allows understanding the existing interactions between them.

Box 4

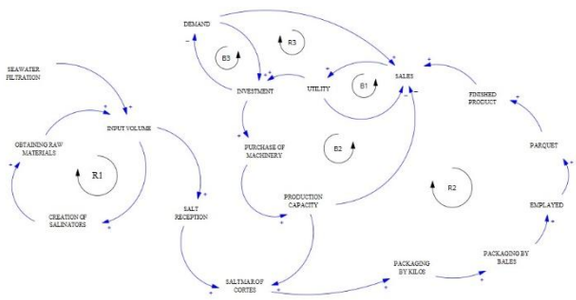

Figure 4

Causal diagram of the Cortés sea salt production process.

Source [Own elaboration, (2024). Create with Vensim ® PLE plus.]

Figure 4 presents the causal diagram that illustrates the main variables involved in the production process of Sea of Cortez salt, ranging from the procurement of raw materials to the distribution of the final product.

In this diagram, the variables are interconnected by arrows that indicate the direction of causality, representing how changes in one variable affect the others within the system.

In addition, the diagram identifies and classifies feedback loops into two categories: reinforcing loops and balancing loops, which play a crucial role in the dynamics and stability of the production process.

Considering the system loops, loop R1 illustrates the initial production process: seawater filtration provides the raw material that is used to create salinizers, thus increasing the salt reception and input volume into the system. Loop R2 focuses on production capacity and how this influences the amount of finished product, which is emplayed and packaged for distribution. In loop R3, demand is crucial; an increase in demand drives sales, which increases profit. With higher profits, the company can invest in improving production capacity by acquiring new machinery.

In loop B1, the impact of sales on profit and the reinvestment of this profit back into the system is highlighted. As the company increases its investments to improve production, it may face resource constraints that could slow down growth. On the other hand, loop B2 links production capacity to the purchase of machinery. Although the acquisition of new machinery can increase production capacity, it also entails significant costs that must be considered. Finally, loop B3 shows how demand influences sales and, consequently, profit. If demand exceeds production capacity, it may be impossible to satisfy all potential sales, which could reduce profit and limit future investments.

- **Development of Forrester diagram**

Taking into account the previous results so far, we proceeded to develop the flow and level diagram (Forrester) which, as mentioned above in the methodology section, converts the qualitative conceptualization into a quantitative mathematical model for its simulation and generation of data for decision making, which is illustrated in the following figure.

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Box 5

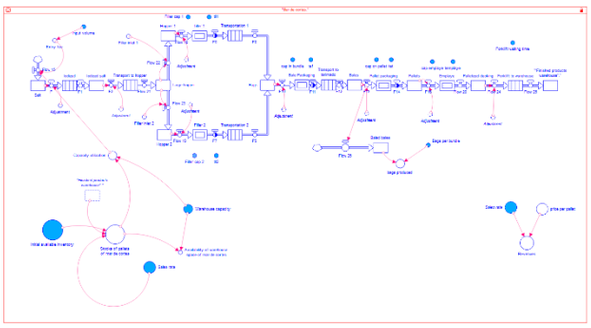

Figure 5

Forrester diagram of the Cortés sea salt production process.

Source [Own elaboration, (2024). Create with Stella® Architect, version 1.6].

The Forrester diagram is composed of several elements, including level variables, flows, variables and parameters, which are categorized according to the following table.

Box 6

Table 1

Elements present in the flow diagram and levels.

Element	Category	Type
Level	Stock	Raw salt inventory Iodized salt inventory Large hopper salt inventory Hopper 1 Hopper 2 Salt bags Salt bales Salt pallets Finished product warehouse Packed bales
	Conveyor	Iodized Transport to hopper Transport 1 Transport 2 Transport to palletizing Transport to warehouse
	Oven	Filler 1 Filler 2 Bale Packing Pallet Packing Emplaye
Flows	Flow	23 flows
Variables	Variables	-Salt input volume to the process per shift. -Filler inlet. -Filler input 2. -Initial available inventory. -Selling rate -Price per pallet. -Revenue
Parameters	Parameters	- Finished product warehouse capacity. -Filler capacity 1. -Filler 1 filling time. -Filler capacity 2- -Filler 2 filling time. -Bale packing capacity. -Bundling time. -Palletizing capacity. -Palletizing time. -Emplaye capacity. -Palletizing time. -Forklift waiting time.

Source: Own elaboration, (2024).

By way of summary, the Forrester model under study is made up of a total of 21 level variables, of which 10 correspond to the stock category, 6 to conveyor and the remaining 5 to Oven; 23 flows; 7 variables, 12 parameters and 55 mathematical equations. Being the variables and parameters possible values to be modified according to the nature of the study under development.

- **Model validation**

A crucial element of the methodology under development is the validation of the model, since its purpose is to identify the reliability of the tool according to the results it produces, so to make this possible it is required to simulate it on different occasions. For the purpose of the research, it was simulated under real production situations taking into consideration working days of one day (1,440 minutes) since the organization maintains its production process 24 hours a day sectored in three shifts of 8 consecutive hours. For validation purposes, three validation techniques were implemented: unit consistency, extreme tests and back testing.

The first test i mplemented was the unit consistency test, which in simulation methodologies, allows to evaluate the logic that exists between each of the units present in the model and the changes that these present as time passes and thus the transformation of units during the production process, where for purposes of the system under study focuses on confirming that the raw salt entering the process is converted to finished product correctly through units such as kilogram of raw salt, kilogram of iodized salt, bags of salt, bales of salt and finally pallets of salt.

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This test according to the software used Stella architect, this one emits in the screen of the same one an announcement of alert when inconsistencies are found in the present units of cutting the bar of tasks is shown clean of notifications as it is shown in the following illustration.

Box 7

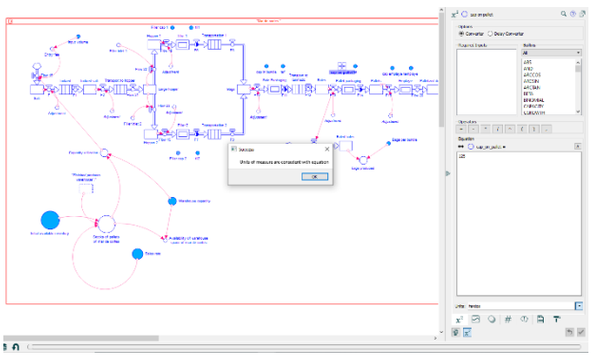

Figure 6

Application of validation test for consistency of units.
Source [Own elaboration, (2024). Create with Stella® Architect, version 1.6].

As can be seen in the illustration, it can be identified that in the lower right corner the task bar is free of notifications, which indicates that the developed model is consistent.

A second validation test is the extremes test which, as its name indicates, consists of subjecting the model to extremes in its main variables in order to evaluate its behavior. For the purposes of the study, the input volume variable was subjected to 0 kg of salt per shift, i.e. no raw material entering the processing, yielding the following result.

Box 8

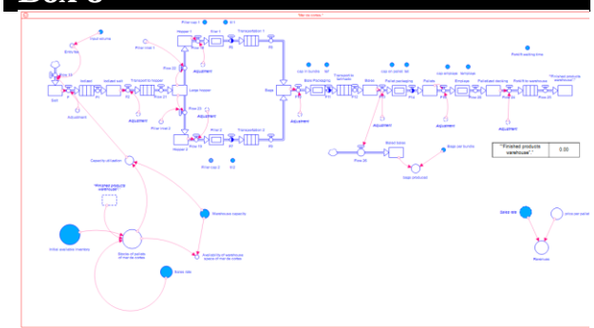

Figure 7

Model validation by extremes test
Source [Own elaboration, (2024). Create with Stella® Architect, version 1.6].

When the value of salt input to the process is modified to 0 kg per shift, a logical behavior is observed in the production system. This modification results in the absence of productive operations, which translates into zero production, with a total of 0 pallets of salt produced. Additionally, the absence of elements in the levels and flows of the process is evidenced, reflecting a complete stop in the production activity.

The third and last test is the retrospective analysis, which consists of comparing the data obtained through the simulation against the real results obtained in the organization, where it is observed that according to the simulation developed, a total of 65 pallets per day are generated, while according to the real results present in the organization, between 59 and 63 pallets per day are produced daily, which represents between 9.3% and 3.07% of the total production. 3 % and 3.07% of error, deriving at all times that the simulation is higher than the real production, this because the simulated model does not contemplate elements of line stoppage for various reasons such as meal time, operation failures, maintenance, set up, among others.

Taking into account the results obtained in the three validation tests mentioned above, it is considered that the model is valid and reliable for its implementation for decision making by the organization's management; therefore, in accordance with the continuous improvement process established in the methodology, the model did not require calibration.

- **Sensitivity analysis**

Considering that the model is valid and reliable, we proceeded to the development of the sensitivity analysis, where it was necessary to identify the sensitive variables and parameters in the model, these being those associated with the capacity of fillers 1 and 2, so three scenarios were evaluated, one of these associated with the optimal conditions of the system, the second under normal conditions (real) and the third and last one of pessimistic character, this being possible by modifying the sensitive variables and parameters in a positive and negative way, reflecting the results in the following table.

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Box 9

Table 2

Scenario analysis

Parameter	Normal scenario value	Optimistic scenario value	Pessimistic scenario value
Volume of salt input to the process per shift	34000 kilograms	34000 kilograms	34000 kilograms
Filler 1 capacity	1 bag at a time	2 bag at a time	0 bags at a time
Filler 2 capacity	1 bag at a time	2 bag at a time	1 bag at a time
Bale packing capacity	12 kilograms per bale	12 kilograms per bale	12 kilograms per bale
Emplaye capacity	125 bales per pallet	125 bales per pallet	125 bales per pallet
Total pallets produced	65 pallets	139.97 pallets	43.14 pallets

Source: Own elaboration, (2024).

For the purposes of the real scenario (standard), it is modeled under current conditions which present stable processes due to the low variability in them, thanks to the standardization of these, however, they present over inventory of finished product as a result of the presence of unpredictable demands among other factors external to the organization. The current conditions can be analyzed that the salt production process has two fillers, each one with the capacity to pack one bag at a time, as well as a single bale packer, a pallet packer and a single bagging machine, producing a total of 65 pallets of salt during a working day, being this possible with the entry of 34 tons per shift according to the value assigned in the parameter of volume of salt input volume to the process per shift.

On the other hand, an optimistic scenario for the company under study would imply a significant increase in its production capacity, which translates to include an increase in the filling capacity to improve the efficiency of the process and thus optimize the supply chain, thus achieving a better sales position to meet the increased demand in the market, these changes are based on increasing the capacity of the fillers, i.e. from going from one bag at a time to two bags per filler and reducing the filling time, considerably increasing the production of salt pallets to a total of 139.

This will significantly increase salt pallet production to 139,97 pallets per day, exceeding current production by 115%, without generating bottlenecks in the subsequent processes of palletizing and emplaye.

Finally, in relation to the sensitivity analysis for the pessimistic scenario, the organization would face a significant decrease in production capacity due to various factors such as the presence of technical problems in the fillers, which results in a drastic reduction in the production of pallets per day, thus negatively impacting the amount of products available for marketing, This analysis shows that the process variables decrease, one of the fillers simulating that it is not in operation, which generates a reduction in the filling capacity and therefore reduces the total production of pallets to a total of 43 pallets per day, increasing the number of pallets per day. 14 pallets per day, thus increasing the in-process inventory (salt waiting to be packed).

- **Graphic interface design and communication**

The last result is the development of the graphic interface and its communication, which provides a simple way to interact with the model under study, by means of graphic blocks that represent different components and relationships within the system. The interface design represents the means by which the model is simplified and allows the user an accessible communication, thus facilitating the understanding and analysis of data for decision making from the variation (simulation) in the various variables and parameters present in the model, where for the purposes of the study the developed interface consists of several screens in which the start menu, control panel for interaction and display of results of both production and storage of finished product, which are presented below.

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Box 10

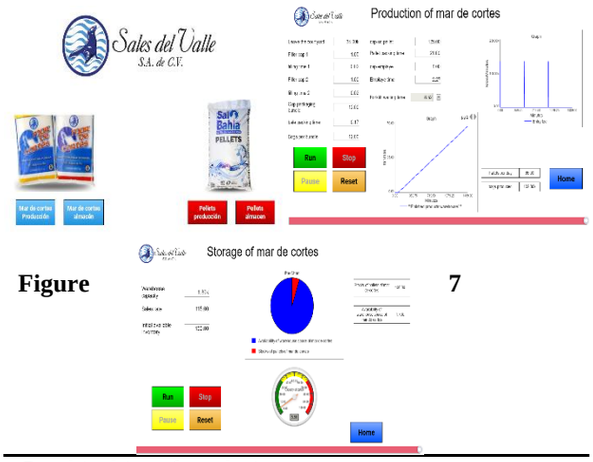

Figure 7

Graphical interface design.
Source [Own elaboration, (2024). Create with Stella® Architect, version 1.6].

As can be seen, the main purpose of the graphic interface is based on the generation of data in graphic form for analysis and development of information of interest for decision making over time.

Conclusions

The development of this research focused on the creation of a graphical interface as a technological tool for the simulation of the production process of sea salt of Cortez of food character, with the purpose of supporting the managers of the organization to streamline the management of quantitative information for decision making.

In particular, for the purposes of the study, it is focused on determining the element of the process that compromises the production of salt, specifically the packaging process (fillers), which generates a bottleneck during the process, since it can be observed that even when a greater amount of raw salt enters in the input volume, this does not increase the production of pallets as a final result, but generates an increase in the inventory of product in process prior to packaging.

However, by increasing the packaging capacity from one bag at a time to two bags per filler, this does increase considerably the final result (production of salt pallets), without compromising the subsequent processes (baling, palletizing and wrapping), so it is determined that these processes have slack according to their design capacities.

Therefore, considering the aforementioned, the organization's managers should contemplate increasing the packaging capacity by various actions such as investment in new packaging equipment. At the same time, the tool allows generating simulations in the system prior to making any type of investment in machinery and equipment involved in the process.

Finally, it is worth mentioning that the tool developed is generated as a scalable tool that can be applied to various production processes of other types of salt present in the organization, since it only requires modification of the parameters under study.

Statements

Conflict of Interest

The authors declare that they have no conflicts of interest. They have no known competing financial interests or personal relationships that might have appeared to influence the article reported in this paper.

Authors' contribution

Specify the contribution of each researcher in each of the points developed in this research.

Vega-Telles Ernesto Alonso: Contributed as technical responsible in the development of the project and documenting the results.

Bueno-Solano Alfredo: Contributed with the generation of models for the simulation of the object of study as well as documentation of results.

Acosta-Quintana Maria P.: Contributes with the documentation of results and their dissemination.

Suastegui-Ramos Francisco: Contributes with the recovery of data within the organization, and development of the model under study.

Availability of data and materials

Research data are available at ernesto.vega99367@potros.itson.edu.mx.

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Journal Economic Systems 8[14]1-9: e20814109
Article

Financial education and its relationship with eighth-quarter students of the bachelor's degree in business innovation at a university in Cancun

La educación financiera y su relación con los alumnos de octavo cuatrimestre de la licenciatura en innovación de negocios en una universidad de Cancún

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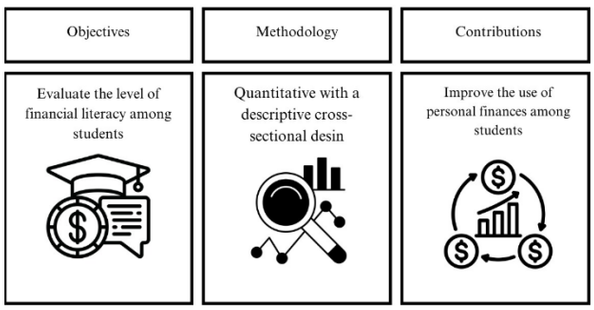
Abstract

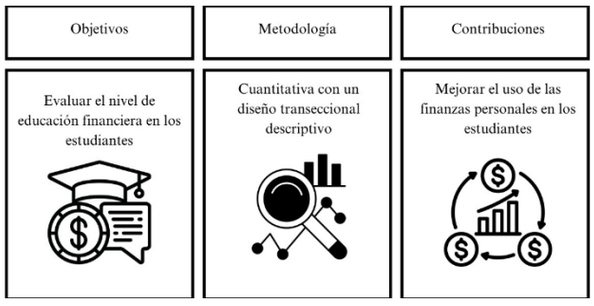
Knowledge about financial education has gained greater importance among university students, as they now recognize the need to learn how to manage their finances and increase their wealth. In this context, the present research aims to evaluate the level of knowledge about financial education among students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun. To achieve this objective, a questionnaire was designed and applied that favors the descriptive method, in a sample of 113 students who voluntarily agreed to participate as study subjects. The questionnaire covered several key dimensions related to financial education, including budget planning, consumption, credit, investment, and savings. The results of the research will allow the identification of strengths and weaknesses in students' knowledge of financial education, which can be used to design more effective and personalized financial education programs to improve students' financial skills.



Financial education, Financial culture, Personal finance

Resumen

El conocimiento sobre educación financiera ha adquirido mayor importancia entre los estudiantes universitarios, ya que ahora reconocen la necesidad de aprender a administrar sus finanzas y aumentar su patrimonio. En este contexto, la presente investigación tiene como objetivo evaluar el nivel de conocimiento sobre educación financiera de los estudiantes del octavo cuatrimestre de la Licenciatura en Innovación de Negocios de una Universidad en Cancún. Para lograr este objetivo, se diseñó y aplicó un cuestionario que favorece el método descriptivo, en una muestra de 113 estudiantes que aceptaron participar voluntariamente como sujetos de estudio. El cuestionario abarcó varias dimensiones clave relacionadas con la educación financiera, incluyendo la planeación del presupuesto, el consumo, el crédito, la inversión y el ahorro. Los resultados de la investigación permitirán identificar las fortalezas y debilidades en el conocimiento de los estudiantes sobre educación financiera, lo que puede ser utilizado para diseñar programas de educación financiera más efectivos y personalizados para mejorar las habilidades financieras de los estudiantes.



Educación financiera, Cultura financiera, Finanzas personales

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Introduction

Today, financial management is a topic of great relevance globally, as taking care of money and acquiring financial skills from an early age are fundamental for economic well-being and financial stability.

This interest in financial well-being arises in part due to the financial crises that have affected various regions of the world, which have been caused by a lack of financial awareness and inadequate management of resources. Young people, in particular, are unaware of the benefits and responsibilities of participating in the country's financial system.

Financial education is an essential component for the integral formation of students, especially those who are about to enter the world of work and face critical economic decisions. In the context of students in the eighth semester of a Bachelor's degree in Business Innovation at a university in Cancun, it is essential to assess and understand their level of financial knowledge and how this influences their behaviour in relation to the variables of budgeting, saving, credit and investment.

Problem statement

In terms of financial education, an unfavourable scenario is observed in the level of knowledge of basic economic-financial concepts and in the adoption of behaviours and attitudes that are considered positive for the better management of personal finances. The significant gap in the adoption of these behaviours and attitudes among people with a higher academic level is a clear indicator of the need to improve financial education in Mexico.

The National Survey on Financial Inclusion (ENIF) 2021 aims to boost financial inclusion and financial literacy, as well as the protection of the population using financial products in Mexico.

The situation in Mexico is critical, as it is below the OECD average in financial capability. Most Mexicans spend more than they earn due to a lack of financial education, and very few Mexicans have received financial education from any school system.

Lack of financial education becomes an aggravating factor in social problems, as vulnerable groups have little or no financial education and are likely to live in conditions of poverty and marginalisation.

Awareness of the importance of improving people's financial capabilities has increased significantly globally. This is due to several factors, including evidence of low levels of financial literacy, increasing personal responsibilities in areas such as health and pensions, and the emergence of increasingly complex financial markets.

Global institutions such as the OECD, the World Bank and the G20 have identified financial literacy as a priority for improving financial stability and the economic well-being of individuals. In Mexico, the majority of university graduates in less than three years are in debt, with credit cards and mortgages. This may be due to several factors, including the low reading level in the country and the low interest of the majority of the population in learning to improve their quality of life. (ENIF, 2021).

Financial education aims to enable people to identify economic opportunities and manage their money effectively. It is a form of self-education that can be found in books and entrepreneurial magazines, and it is not just about becoming rich, but about being self-educated and knowing how to manage one's finances. (ENIF, 2021)

Justification

One of the major concerns nowadays is to provide financial education to young people, as they have realised how important it is in the course of their lives. However, in many cases they do not acquire sufficient knowledge on how to do it, since they are not given the necessary tools and do not develop their capacities to start this path in the best possible way. In the municipality of Benito Juárez, Quintana Roo alone, in the period 2022-2023 in higher education there are 29,026 students, more than half of whom are not given the tools to invest their money (information provided by the Planning Directorate of the Ministry of Education of Quintana Roo).

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The aim of this research is to provide relevant information on students in the eighth semester of the Business Innovation course at a university in Cancun so that teachers interested in financially educating young people can make them aware that they are at the best stage of their lives to contribute to making financial decisions and their influence on the family nucleus, so that in the future they can enjoy economic freedom that will allow them to progress in their lives and in the economic life of the state.

Objectives

General objective

To evaluate the level of financial education measured through learning and behaviour in the variables of budgeting, saving, credit and investment of young students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun.

Specific objectives

To determine the level of learning in financial education about budgeting of young students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun.

To identify the level of financial literacy behaviour in terms of savings among young students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun.

To find out the level of financial education about credit among young students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancún.

To determine the level of financial education about investment of young students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun.

Research Questions

What is the level of financial education about budgeting of eighth-quarter students of the Bachelor's Degree in Business Innovation at a university in Cancun?

What is the level of financial education about saving among eighth-quarter students of the Bachelor's Degree in Business Innovation at a university in Cancún?

What is the level of financial literacy about credit among eighth-quarter students of the Bachelor's Degree in Business Innovation at a university in Cancún?

What is the level of financial literacy about investment among eighth-quarter students of the Bachelor's Degree in Business Innovation at a university in Cancun?

Theoretical framework

Yaringaño (2018) conducted a study whose general objective was to identify the financial knowledge of university students and to verify whether there were significant differences when comparing them according to the variables gender, age, professional career, marital status, having children, having a job and having a debit or credit card. A second objective was to involve students in the process of data collection and analysis in order to develop the competences associated with the research.

In the same vein, it was described that, in the case of a person who is not well informed or who has little knowledge in the economic and financial sphere, he or she will not be able to make the best decisions, nor will he or she be able to reflect on the options that are the most profitable in economic terms. With regard to expenses, investment-related topics were not analysed, because any individual needs information and basic knowledge that allows them to compare the benefits or profits in each of the options offered by the financial systems, so that with this knowledge they can choose the best alternative (Céspedes, 2017).

Education

Education can be defined as communication (ideas, knowledge, strategies) that is organised and sustained and designed to produce learning (OECD, 2015).

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It is the set of mechanisms that contribute to the socialisation of individuals and must necessarily have a certain permanence in time and space. Furthermore, it is the action and effect of educating and is a process of transmitting the cultural background of a community or social group in order to perpetuate its own existence and continued development.

There are two types of education, formal and informal, the former refers to education received in an educational institution. It uses the tools of pedagogy to achieve its objectives. In general, this education is usually divided in order to facilitate assimilation by the person being educated. While informal education is that which teaches contents, skills, forms habits and values outside the educational institutions, it is spontaneous, it does not establish a graded process in levels, nor does it require the approval of subjects and courses.

Through education, knowledge is assimilated, which, once applied, should lead to a higher level of well-being, which is why education should be permanent (Ruiz, 2011).

Financial education

Moreno, García and Gutiérrez (2017) state that financial education refers to the ability to make the right choice of financial instruments. But this subject should not only be limited to this knowledge but also to the understanding that each individual has of financial matters, with respect to the care and treatment that should be provided from a less technical point of view, ranging from personal budgeting to saving for security and social welfare. This subject should be worked on as a basic and very important training to be able to make the best decisions according to the needs of each individual, thus forging solid foundations in our financial education.

The Organisation for Economic Co-operation and Development (OECD) defines financial education as 'a combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and, ultimately, to achieve individual financial well-being'.

Financial education is a win-win investment for both customers and financial service providers. An informed client represents better outcomes by providing the knowledge, skills and attitudes required to adopt good money management practices in terms of earning, spending, saving, borrowing and investing. In other words, it teaches the tools necessary to make better financial decisions and achieve better control over risks in order to achieve goals that will improve the economic well-being of individuals and institutions (Carbajal, 2008).

Financial education is one of the methods used to inform and instruct users, through which they are encouraged to become more involved and aware of their financial operations, in the hope of improving their decision-making. As a result of this process, the construction of a more efficient financial system could be gradually generated (Vargas, 2011).

Personal finance

One of the strategic tools for financial decision-making is the management of personal finances, which allows people to have economic peace of mind (Ramírez et al, 2019).

The previous concept can be explained as the administration or distribution of the economic resources of each person. It involves the search for how to generate one's own income, how to manage it and, finally, deciding how this income will be spent, whether on food, consumption of goods and services or whether to analyse the possibility of allocating part of it to savings or investment.

In order to contextualise and express in a better way the previous concept, it can be added that this type of topics are being put aside in the area of personal finances, since the areas of economics and finance have been focusing mainly on corporate, administrative and financial services finances, leaving each individual to develop on their own according to the experience they can acquire through the trials and errors of their financial actions (Figueroa, 2009).

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Financial culture

Financial culture is the development in relation to traditions, beliefs, future monetary expectations, knowledge, systems, images, language, teachings, forms, values and lifestyles within financial communities and their interrelation with the economic agents with whom they interact (Tostado, 2005). In other words, financial culture is that which the individual obtains throughout his or her financial life through traditions, customs, knowledge and teachings.

Talking about financial culture leads to the relationship that a society has with the financial environment, an environment that ranges from personal finances such as drawing up a family budget, making the most of financial resources, savings culture and planning, responsible consumption, recurrent expenses and credits to the services offered by the Mexican financial system such as savings, investment, savings plans, afores, investment companies, etc. (Higuera and Serrano, 2009).

Method

The research is based on the replication of the method of Espinoza (2018) and is descriptive because it collects data on the perception of financial education in students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun, it seeks to have a quantitative approach, as its aim is to analyse and describe each of the dimensions that make up the study of financial education (budgeting, saving, credit and investment). The design will be non-experimental, transactional and descriptive.

In the present research, the population is made up of 113 students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun.

The technique through which the data was collected was the survey that was applied in order to measure the variables of study (budget, savings, credit and investment) which make up the ‘Financial Education’.

In order to determine the results of the present study, a questionnaire was elaborated, which is designed on the basis of thirty questions on financial education.

Interpretation

Box 1

Table 1

General data of students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun

		Frequency	Porcentage
Sex	Women	72	63,7%
	Man	41	36,3%
Marital Status	Single	113	100,0%
	Married	0	0,0%
No. of family members	From 1 to 3	42	37,2%
	From 4 to 5	59	52,2%
	From 6 to more	12	10,6%
Employment status	Active	84	74,3%
	Inactive	29	25,7%

Source: Own elaboration

The table provides an overview of the 113 young students who participated in the financial education survey. Most of the students are female (72, i.e. 63.7%), while all of them are single. In terms of the number of family members, the majority have between four and five family members (59 students, i.e. 52.2%), followed by those between one and three family members (42 students, i.e. 37.2%). In terms of employment status, the majority of students are in employment (84 students, i.e. 74.3%), while 29 students (i.e. 25.7%) are inactive.

These data may be useful to better understand the demographic and employment characteristics of students and how these may influence their perception and knowledge of financial literacy.

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Box 2

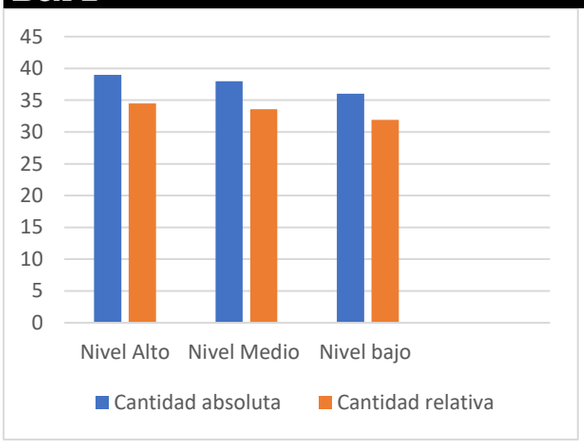

Figure 1
Level of financial education about budgeting among eighth semester students of the Bachelor's Degree in Business Innovation at a University in Cancun - Year 2024

Source: Own elaboration

The graph of financial literacy in relation to budgeting revealed that the majority of students have a moderate level of financial literacy, with 38 students (33.6%) having a medium level of financial literacy in budgeting and management, while 36 students (31.9%) have a low level, i.e. they do not manage their resources properly. Only 39 students (34.5%) have a high level of financial literacy in relation to budgeting, which means that less than a third know how to budget correctly, what its benefits are and think it is important to control their money. These results suggest that many students may need more knowledge and skills to manage their finances effectively.

Box 3

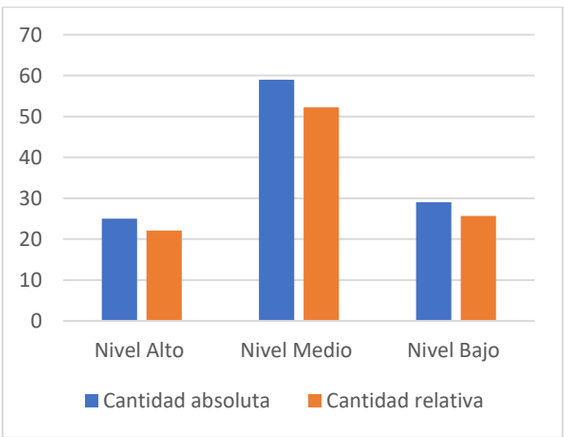

Figure 2
Level of financial education about savings among students in the eighth semester of a Bachelor's Degree in Business Innovation at a University in Cancun - Year 2024

Source: Own elaboration

The results of the research on financial education in terms of savings among students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun show that 25 students, representing 22.1%, have a high level of savings, as they recognise the importance of maintaining this habit to improve their standard of living in the future. On the other hand, 59 students, corresponding to 52.2%, have a medium level, have the habit of saving monthly and save at least 10% of their monthly income, while 29 students, equivalent to 25.7%, have a low level. This suggests that they have a basic understanding of the concept of saving, so they need support to improve their skills.

Box 4

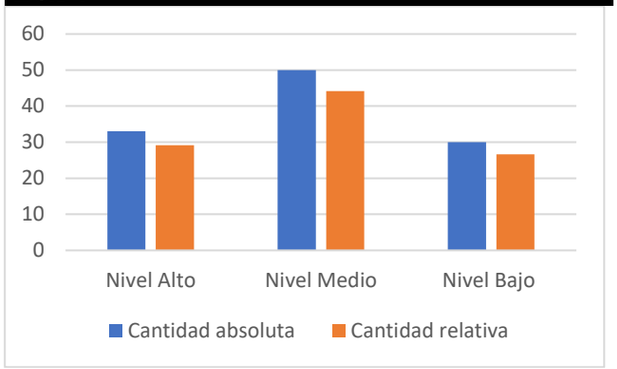

Figure 3
Level of financial education about Credit among eighth semester students of the Bachelor's Degree in Business Innovation at a University in Cancun - Year 2024

Source: Own elaboration

According to the results of the research on the level of financial education about credit among students in the eighth semester of the Bachelor's Degree in Business Innovation at a university in Cancun in the year 2024, the following was found:

A total of 33 students, representing 29.2%, demonstrated a high level of financial knowledge and skills related to credit. On the other hand, 50 students, equivalent to 44.2%, were at a medium level of financial literacy in this area. Finally, 30 students, or 26.6%, had a low level of credit-related financial literacy.

These data suggest that while the majority of students have a basic understanding of financial concepts related to credit, there is a significant group that requires further support and education to strengthen their skills in this area.

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Furthermore, the fact that almost a third of the students demonstrated a high and medium level of financial literacy in terms of credit indicates that the university is achieving positive results in the training of these future professionals, so it can be deduced that they know how to apply for credit in formal financial institutions, have a good credit history, are punctual with the payment of their instalments, are aware of the various means of payment and make good use of them.

Box 5

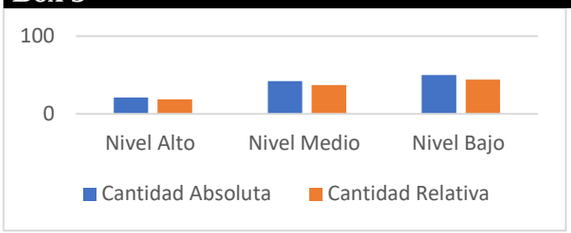

Figure 4

Level of financial education about investment among students in the eighth semester of a Bachelor's Degree in Business Innovation at a University in Cancun - Year 2024

Source: Own elaboration

According to the results of the research on the level of financial education in terms of investment among eighth semester students of the Bachelor's Degree in Business Innovation at a university in Cancun, it was found that 21 students, representing 18.6%, have a high level of knowledge in this area since they know about investment options, the risks that may arise in the investment process, and/or have received economic benefits from an investment they have made.

On the other hand, 42 students, equivalent to 37.2%, were at a medium level, which means that they have made an investment in a business or in the acquisition of an asset, but that they do not know more about the subject in depth. However, the majority, 50 students, corresponding to 44.2%, demonstrated a low level of financial education related to investment as they have no knowledge of how to make an investment and in which business to invest.

Conclusions

Assessing and improving financial literacy among students in the eighth semester of the Bachelor in Business Innovation at a university in Cancun is an essential task.

It not only prepares them to better manage their personal finances, but also gives them a competitive advantage in the professional arena. According to the results, students have a regular level of financial education; this means that they organise their resources according to their lifestyle, some know their monthly income and expenses, but do not keep a comprehensive control over them. Some use the financial system to save, but most apply for loans to cover monthly expenses because they are not enough with their salary or do not know how to manage it. Moreover, they do not invest in their own business because of their adaptation to subordinate jobs. In spite of this, they manage to get used to their rhythm of life without achieving financial and economic independence.

The area in which they need more support and training is investment, as it is very low, so it is considered that they do not know how to invest, and if they do know how to invest, they do not know how to do it. They limit themselves to investing because of the difficulty of controlling the risk of loss.

The research results reveal significant findings that can guide the implementation of educational programmes and policies to strengthen financial education at the university level. It is crucial to include training on these topics to define students' skills, capacities and competencies. In addition, it is crucial for teachers of economic subjects to be aware of the importance of providing students with the necessary knowledge to become aware of their actions and understand the influence that basic financial topics have on their decisions and personal growth.

In this way, students will be able to enjoy the financial freedom they long for.

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Declarations

Conflict of interest

The authors declare that they have no conflicts of interest. They have no known competing financial interests or personal relationships that might have appeared to influence the article reported in this paper.

Authors' contribution

López Cetina, Yamit: research leader.

Sergio Roberto Preza Medina: especialista metodologías cuantitativas y análisis de datos/ quantitative methodologies and data analysis specialist.

Hernández Chacón, Sandra: especialista metodologías cuantitativas y recolección de datos/ quantitative methodologies and data collection specialist.

Chan Ac, Irving Arlin: recolección e interpretación de datos/ data collection and interpretation.

Availability of data and materials

Data openly available in a public repository that issues datasets with DOIs

Data openly available in a public repository that does not issue DOIs

Data derived from public domain resources.

Data available on request to authors.

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Abbreviations

CNBV Comisión Nacional Bancaria y de Valores (National Banking and Securities Commission)

ENIF National Financial Inclusion Survey

INEGI Instituto Nacional de Estadística y Geografía (National Institute of Statistics and Geography)

OECD Organization for Economic Cooperation and Development

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Journal Economic Systems 8[14]1-10: e30814110
Article

Perception and use of public space in Puerto Vallarta. A comparative analysis between men and women

Percepción y uso del espacio público en Puerto Vallarta. Análisis comparativo entre hombres y mujeres

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Abstract

Objectives: To analyze and compare the perception and use of public space in Puerto Vallarta between men and women. Methodology: This is a quantitative, cross-sectional, and descriptive study that included 150 participants (56% women and 44% men). Contribution: Although men and women use these spaces with similar frequency, their experiences differ significantly by gender. Women engage in a more diverse use of public spaces, often utilizing them more frequently for caregiving-related activities. Nevertheless, they face higher incidences of harassment and feel that these spaces fail to fully meet their needs. These findings emphasize the importance of incorporating a gender perspective into the study of public spaces and the formulation of urban policies.

OBJECTIVE	METHODOLOGY	CONTRIBUTIONS
To analyze and compare the perception and use of public space in Puerto Vallarta between men and women.	This is a quantitative, cross-sectional, and descriptive study that included 150 participants (56% women and 44% men).	Experiences in space differ significantly by gender. Women engage in a more diverse use of public spaces, often utilizing them more frequently for caregiving-related activities. They face higher incidences of harassment and feel that these spaces fail to fully meet their needs. These findings emphasize the importance of incorporating a gender perspective into the study of public spaces and the formulation of urban policies.

Public space, gender, urbanism

Resumen

Objetivos: Analizar y comparar la percepción y el uso del espacio público en Puerto Vallarta entre hombres y mujeres. Metodología: Se trata de un estudio cuantitativo de corte transversal y de alcance descriptivo. Incluyó 150 participantes (56% mujeres y 44% hombres). Contribución: Aunque hombres y mujeres utilizan estos espacios con una frecuencia similar, sus experiencias difieren significativamente según el género. Las mujeres hacen un uso más diverso de los espacios públicos, utilizándolos con mayor frecuencia para actividades relacionadas con el cuidado. Sin embargo, enfrentan mayores incidencias de acoso y sienten que estos espacios no satisfacen completamente sus necesidades. Estos hallazgos enfatizan la importancia de incorporar la perspectiva de género en el estudio de los espacios públicos y en la formulación de políticas urbanas.

OBJETIVO	METODOLOGÍA	CONTRIBUCIONES
Analizar y comparar la percepción y el uso del espacio público en Puerto Vallarta entre hombres y mujeres	Se trata de un estudio cuantitativo de corte transversal y de alcance descriptivo. Incluyó 150 participantes (56% mujeres y 44% hombres).	Las experiencias en el espacio difieren significavtivamente según el género. Las mujeres hacen un uso mas diverso de los espacios públicos, utilizandolos con mayor frecuencia para actividades relacionadas con el cuidado. También enfrentan mayores incidencias de acoso y sienten que estos espacios no satisfacen completamente sus necesidades. Estos hallazgos enfatizan la importancia de incorporar la perspectiva de género en el estudio de los espacios públicos y en la formulación de políticas territoriales.

Espacio público, género, urbanismo

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Introduction

There are various definitions of public space. From the functionalist approach and from the physical-spatial sphere, we have, for example, the definition of the 'Charter of public space', which defines it as places for public use, free and for all; streets, parks, public squares; residual spaces, roads and bridges (II Biennial of Public Space, 2013; Villegas Guzmán & Peña Ramos 2023). On the other hand, there are interpretations that consider that public space should be considered as a more complex concept, due to its role not only as a place of socialisation (Ayala-García, 2021), where different dimensions and inequalities are expressed, but also as a space whose conformation influences the reproduction of these inequalities (Ministerio de las Mujeres, Políticas de Género y Diversidad Sexual, 2021). Despite the fact that public space is characterised as being accessible and open to all, the reality is that it generates limitations and exclusions of some social groups, which also makes it a space of conflict and social exclusion, where violence is normalised and inequalities are exacerbated in terms of social and political counterweights (Vicente García, 2022). Therefore, the use of public space becomes a fundamental right of citizenship, and must ensure that different social, cultural, gender and generational groups can appropriate it on equal terms (Muxi & Borja, 2003).

Public space, as a place where diverse social phenomena converge, also functions as a tool for social cohesion. This happens through the sense of attachment generated by the appropriation of spaces, which facilitates greater opportunities for interaction (Flores Dávila, 2020). In this sense, appropriation is recognised as one of the elements in the shaping of identity; and in the specific case of Puerto Vallarta, although the inhabitants continue to identify with their neighbourhoods and districts, they do not extend this link to public space, as they do not feel it as their own or consider it part of their identity, which hinders the construction of a solid collective identity (Chavoya Gama, 2016).

Schlack and Araujo (2022) emphasise the importance of incorporating intersectionality when analysing public space in order to understand the differences between its inhabitants and their interactions within it. With respect to the intersectional perspective, gender analysis becomes an essential tool, as there are gender gaps in the labour, political and/or economic spheres, disparities that are also evident in urban contexts and public spaces (Falú, 2023).

One of the main disparities that exist in users' relations with public space is generated as a result of established gender roles, since household welfare and reproductive tasks have historically been the responsibility of women, while activities that generate monetary remuneration have been carried out over time by men (Palacios Jerves & Hermida, 2020). And while in recent decades women have made massive inroads into the world of work and the public sphere, men have not been involved in the private and care sphere (Alcañiz, 2015; Jiménez Figueroa, et al., 2019). This reality opens up even more inequality gaps, as travelling with young children, older adults or people with disabilities exposes women to greater vulnerability (Palacios Jerves & Hermida, 2020; Peralta & Olivarría, 2022).

In no country in the world is there an equal distribution of care work between men and women, as according to global statistics, women are responsible for 76.2% of the total hours spent on care work; on average, women spend 3.2 times more time than men on unpaid care work (International Labour Office, 2019).

According to data from the National Survey for the Care System (INEGI, 2022), in Mexico there are 10.2 million children aged 0 to 5 who receive care from a family member, 86.3% from the mother and 7.6% from the grandmother, leaving only 6.1% for others. Similarly, of the 1.5 million people over 60 who are dependent and receive care, 44.3% of the main caregivers are daughters or granddaughters. Likewise, INEGI (2022) states that of the total of 22.5 million people aged 15 and over who provide household care in the country, 86.9% are women, compared to 13.1% men.

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The urban environment and caregiving tasks are intertwined with the availability of both public and private services that women caregivers use to meet their own needs and those of their dependents; specifically in public space, this is reflected in traffic conditions and accessibility from aspects such as lighting, safety and accessibility of streets, along with infrastructure for rest, leisure and sanitation (SEDATU, 2021).

Gender inequalities are a structural characteristic of Latin America and the Caribbean, which is manifested in an unbalanced distribution of power, resources, wealth, work, time, opportunities and access to rights between women and men, which is why incorporating a gender perspective in statistics implies recognising and considering the differences in the roles, functions, tasks and responsibilities that women and men are assigned and carry out in different ways (ECLAC, 2021).

These inequalities are also reflected in the differentiation of experiences of harassment and other forms of violence in public spaces, as this is a daily problem faced by women and girls around the world. Although violence against women and girls in the domestic and work environment is now widely recognised as a human rights violation, violence against women and girls in public spaces is often under-recognised, resulting in few laws, policies and protocols to prevent and address such violence (UN WOMEN, 2024).

According to data from the National Survey on the Dynamics of Household Relationships (INEGI, 2021) 45.6% of women have been assaulted in public spaces at least once in their lives in Mexico, of which the majority (64.8%) have identified the street or the park as places of violence. Reaffirming the above, the results of the surveys applied in the framework of the Safe Cities Programme in Mexico City reflect that 88.5% of the women surveyed have suffered sexual harassment and other forms of violence in public spaces at least in the last year, and 70.7% in Guadalajara (UN WOMEN, 2019). Normalising this type of harassment in its different expressions has serious repercussions on women's participation in public life and their daily lives, as the self-protection strategies they are forced to develop distance them from the main place of community coexistence, which affects their quality of life (UN WOMEN, 2019).

In this sense, the UN establishes as one of the goals of the 2030 Agenda, Sustainable Development Goal 11, which seeks to provide universal access to green spaces and safe, inclusive and accessible public spaces, particularly for women and children, older persons and persons with disabilities (UN HABITAT, 2019).

This goal can only be achieved by recognising the key role of public space as an enabler of the fabric of identity, economic development and social cohesion, which directly adds to the shaping of successful, environmentally sustainable and socially inclusive and accessible cities, as enunciated in the New Urban Agenda (UN HABITAT, 2019).

Considering all these aspects that are key to the analysis of Public Space, the present study aimed to analyse and compare the perception and use of public space in Puerto Vallarta between men and women based on frequency of use, type of use, experience of harassment and perception of space. The classification according to their function established by NOM-001-SEDATU-2021 was used, which considers urban green areas (parks, gardens, orchards), squares and esplanades, sports spaces, viewpoints and open spaces in public facilities.

The following section describes the methodology used, followed by the presentation of the results of each analysis variable. Subsequently, the general conclusions are presented, and the text concludes with bibliographical references.

Methodology

Aims: To analyse and compare the perception and use of public space in Puerto Vallarta between men and women based on frequency of use, type of use, experience of harassment and perception of space.

Participants: Consisted of a total of 150 participants (56% female and 44% male), residents of Puerto Vallarta, Jalisco, Mexico, over the age of 15.

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Instruments: A printed and digital questionnaire was used, consisting of 8 questions alluding to frequency and type of use of public space, perception of public space and experience of harassment. The questionnaire was self-administered, using multiple choice questions.

Results

Frequency of use of public spaces

Regarding the frequency of use, the question was asked: How many times a week do you use the square, park or public space in your neighbourhood? As shown in Table 1, the highest percentage of women use it 1 to 2 times, followed by those who do not use it. In third place, with 14.3%, they use it 3 to 4 times, and the lowest percentage (7%) use it 5 times or more.

On the other hand, the highest percentage of men, 27%, do not use public spaces, followed by 25.8% who use it 1 to 2 times. Thirdly, 19.7% use it 3 to 4 times, and the lowest percentage (9%) use it 5 times or more.

Box 1

Table 1

How many times a week do you use the square, park or public space in your neighbourhood?

Sex		Frecuency	%
Woman	None	20	23.8
	1 to 2 times	36	42.9
	3 to 4 times	12	14.3
	5 times or more	6	7.1
	No answer	10	11.9
	Total	84	100
Man	None	18	27.3
	1 to 2 times	17	25.8
	3 to 4 times	13	19.7
	5 times or more	6	9.1
	No answer	12	18.2
	Total	66	100

Source: Own elaboration

Box 2

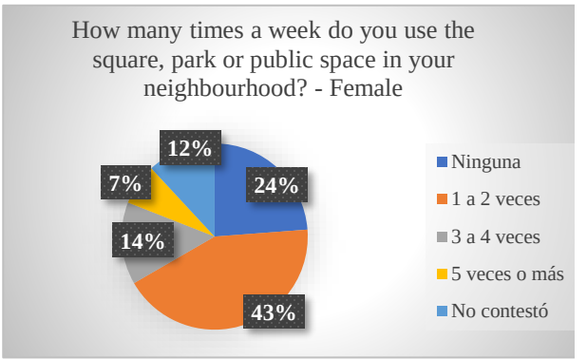

Figure 1

How many times a week do you use the square, park or public space in your neighbourhood? - Woman

Source: Own elaboration

Box 3

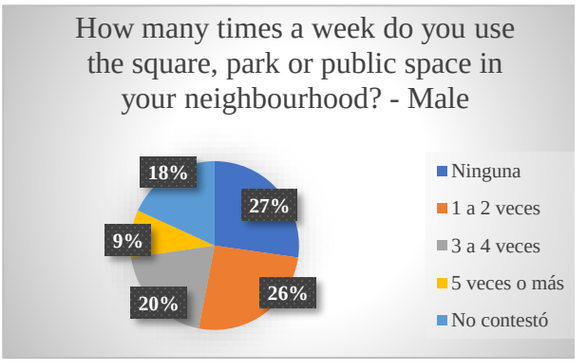

Figure 2

How many times a week do you use the square, park or public space in your neighbourhood? - Male

Source: Own elaboration

Type of use of public spaces

The highest percentage of women (27.4%) use public spaces for exercise, in second place, with 24%, are those who use them for socialising activities, in third place, with the same percentage (14%) are the group of women who do not use them and the group of those who use them to accompany or care for a minor, followed by the group who indicate that they do not have these spaces. A fifth group (6%) indicates that they use them for walking pets, and the last group (3.6%) uses them for reading or school activities. This is illustrated in figure 3.

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Figure 4 shows that the highest percentage of men use the spaces for sporting activities, in second place with 24% are those who use them for socialising and socialising, in third place with 18% is the group that does not use the spaces, followed by 13.6% who indicate that they do not have public spaces. Some 10.6% use the spaces for the care of a child. In last place, there are two groups with 1.5% each who indicate that they use them for school activities and for pet walks respectively.

Box 4

Table 2

What is the activity you do most in this public space?

Sex		Frecuency	%
Woman	Ninguna	12	14.3
	Exercise and/or sporting activities	23	27.4
	Socialisation and coexistence activities	20	23.8
	Accompanying or caring for a minor	12	14.3
	Reading, homework or school activities	3	3.6
	Pet walk	5	6.0
	No square, park or public áreas	9	10.7
	Total	84	100.0
Man	Ninguna	12	18.2
	Exercise and/or sporting activities	20	30.3
	Socialisation and coexistence activities	16	24.2
	Accompanying or caring for a minor	7	10.6
	Reading, homework or school activities	1	1.5
	Pet walk	1	1.5
	No square, park or public áreas	9	13.6
	Total	66	100.0

Source: Own elaboration

Box 5

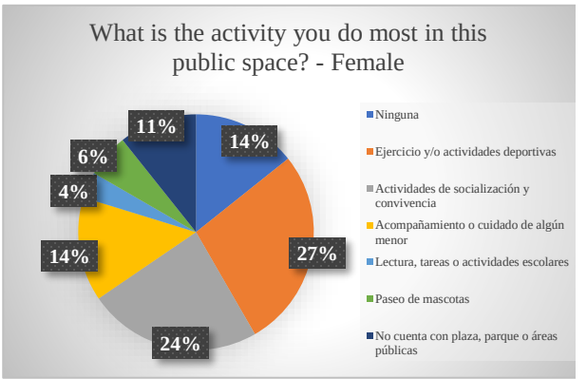

Figure 3

What is the activity you do most in this public space? - Female

Source: Own elaboration

Box 6

Figure 4

What is the activity you do most in this public space? - Male

Source: Own elaboration

Experience of harassment in public spaces

Regarding the experience of harassment in these spaces, the majority of women (35.7%) indicate that they have not had an experience of harassment, however, a very similar percentage of 31% indicate that they have experienced harassment, as illustrated in Figure 5.On the other hand, the majority of men indicate that they have never experienced harassment (53%), while only 6% indicate that they have (Figure 6).

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Box 7

Table 3

Have you experienced any kind of harassment in this public space?

Sex		Frecuency	%
Woman	No	30	35.7
	Yes	26	31.0
	No square, park or public areas	8	9.5
	No contest	20	23.8
	Total	84	100.0
Man	No	35	53.0
	Yes	4	6.1
	No square, park or public areas	9	13.6
	No contest	18	27.3
	Total	66	100.0

Source: Own elaboration

Box 8

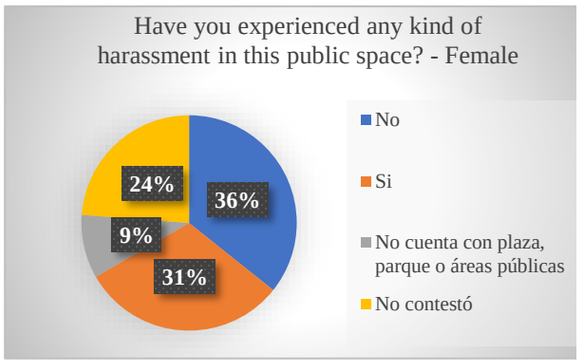

Figure 5

Have you experienced any kind of harassment in this public space? – Female

Source: Own elaboration

Box 9

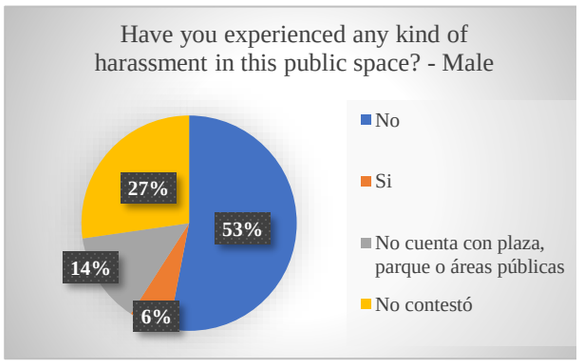

Figure 6

Have you experienced any kind of harassment in this public space? – Male

Source: Own elaboration

Perception of public spaces

Participants were asked whether they felt that the spaces took into account their needs as users. In the women's group, the majority (37%) said no, followed by 26% who said yes (Table 4, Figure 7). Meanwhile, the majority of men (29%) said yes, while a similar percentage (27%) said no.

Box 10

Tabla 4

Do you feel that this public space takes into account your needs as a user?

Sex		Frecuency	%
Woman	Yes	22	26.2
	No	31	36.9
	No square, park or public areas	8	9.5
	No contest	23	27.4
	Total	84	100.0
Man	Yes	19	28.8
	No	18	27.3
	No square, park or public areas	9	13.6
	No contest	20	30.3
	Total	66	100.0

Source: Own elaboration

Box 11

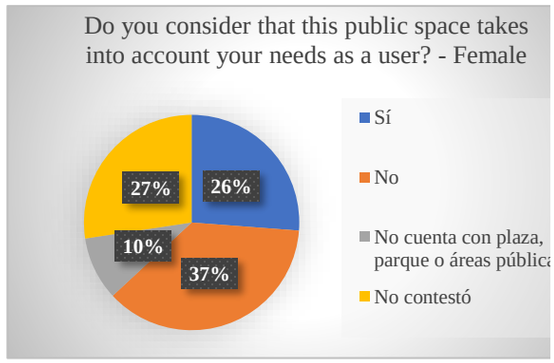

Figure 7

Do you consider that this public space takes into account your needs as a user? – Female

Source: Own elaboration

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Box 12

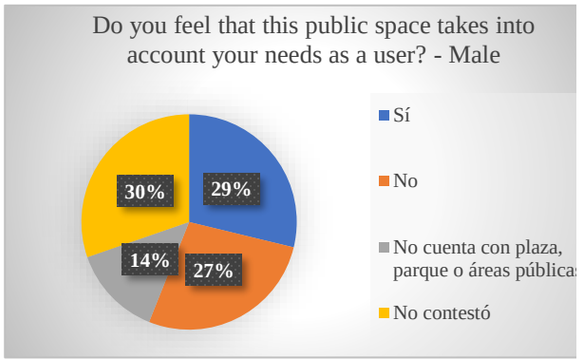

Figure 8
Do you feel that this public space takes into account your needs as a user? – Male
Source: Own elaboration

Conclusions

Frequency of use of public spaces

The results indicate differences in the frequency of use of public spaces between men and women. Some 42.9% of women use these spaces occasionally (1 to 2 times a week), compared to 25.8% of men. On the other hand, men have a greater tendency to make more frequent use of public spaces, with 19.7% visiting them 3 to 4 times a week and 9.1% using them 5 times or more, compared to 14.3% and 7.1% of women, respectively. These data suggest that men have appropriated public spaces to a greater extent, thus having space for social interaction (including with other men).

These data are similar to those expressed by other research, which indicate that there is still a perception of space where the private is considered feminine and the public is considered masculine (Falú, 2023; Palacios Jerves & Hermida, 2020).

Since the Industrial Revolution, cities have been planned according to the sexual division of labour, resulting in an androcentric urban structure, where women have been invisibilised in spaces considered secondary or residual (Quiroga Díaz & Gago, 2020).

And while these inequalities in the public-private dichotomous vision that are expressed in the lesser use that women make of public space may be due to two phenomena, the first, in line with what Quiroga Díaz & Gago pointed out, regarding the fact that cities and spaces maintain structures that do not consider the needs of women, and a second referring to the social construction where women have remained segregated, regardless of the conditions of the spaces (Carrión & Dammert-Guardia, 2019).

Type of use of public spaces

Regarding the type of use given to public spaces, it can be observed that the patterns are similar, as both women and men tend to use public spaces for sports and socialising. However, it is noteworthy that 20% of women use the spaces for care tasks, whether for children or pets, compared to men, where only 11% use them for these purposes.

Gender inequality in the use and perception of cities is manifested, in the first place, through the role that care tasks play in women's lives. According to the ILO (2019), women spend 3.2 times more time than men on unpaid care work. In Mexico, INEGI (2022), states that of the total of 22.5 million people aged 15 and over who provide household care in the country, 86.9% are women, compared to 13.1% men.

These data reveal two fundamental perspectives: a social one, which highlights the structural inequality faced by women as they assume a double working day (paid work and care work), which affects their mobility, their access to and use of spaces, as well as their general wellbeing. This situation highlights the urgency of implementing public policies aimed at promoting the full participation of men in care work, in order to alleviate the disproportionate burden on women.

Similarly, given women's use of spaces in the context of care, urban design must integrate these specific needs in order to not only respond to them, but also to promote social cohesion and reduce rather than deepen gender gaps.

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Experience of harassment in public spaces

The findings reveal a marked gender disparity in the experience of harassment in public spaces, with 31% of women reporting having been victims of harassment, indicating that almost one in three women face harassment, reflecting an alarming reality of insecurity for women. In contrast, only 6.1% of men reported having been victims of harassment, a significantly lower proportion compared to women.

This difference highlights how harassment in public spaces disproportionately affects women, underlining the urgent need to implement gender-sensitive interventions in the design and management of these spaces in order to ensure the safety of all people.

This is in line with UN WOMEN (2019), which states that the normalisation of this type of harassment in its various forms has a profound impact on women's participation in public life and in their daily lives, as it forces them to implement self-protection measures that distance them from the main spaces of community coexistence, which is detrimental to their quality of life.

Perception of public spaces

37% of women expressed that public spaces do not take their needs into account, a higher percentage than men (27.3%), which reflects a considerable dissatisfaction among women. This difference could be related to a lack of urban design that considers gender-specific needs, such as accessibility, safety and availability of resources for care activities. While dissatisfaction is also significant among men, the lower proportion suggests that public spaces tend to be better adapted to their habits and expectations.

This disparity highlights how women, due to their gender roles and exposure to dynamics of harassment or insecurity, experience public spaces differently, which influences their perception. It is therefore crucial to design urban policies with a gender perspective that recognise these differences and promote more inclusive, accessible and safe environments for all users.

These concerns are shared by various studies that point out that gender analysis has become an essential tool for the study of public space (ECLAC, 2021; Falú, 2023).

In conclusion, public space is not homogeneous, neutral or universal, as Muxí (2017) points out, and this is clearly reflected in the results of this study, which show how men and women experience the city and its spaces differently.

This reality cannot be ignored when designing, creating and planning cities. It is essential to make visible the uses and perceptions of all the groups that inhabit them (Palacios Jerves & Hermida, 2020; ECLAC, 2021). In this regard, the UN establishes as one of the targets of Sustainable Development Goal 11 for 2030 to provide universal access to green spaces and public spaces that are safe, inclusive and accessible, especially for women, children, older persons and persons with disabilities (UN HABITAT, 2019).

To achieve this goal, it is imperative to recognise the key role of public space as an enabler of the fabric of identity, a driver of economic development and a promoter of social cohesion. This contributes directly to the creation of successful, environmentally sustainable, socially inclusive and accessible cities, as set out in the New Urban Agenda (UN HABITAT, 2019).

Finally, ensuring women's access to public spaces is a crucial step towards their greater inclusion in political and institutional spheres (UN HABITAT, 2019).

Limitations and recommendations

A limitation of the study was the failure to explore in depth intersectional factors such as age, ethnicity and socio-economic status, which could significantly influence the perception and use of public space. For future research, it is recommended that a more in-depth intersectional approach be incorporated to allow for a more comprehensive understanding of urban dynamics.

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Statements

Conflict of interest

The authors declare that there are no financial interests or personal relationships that may have inappropriately affected the development and publication of this manuscript.

Author contribution

Both authors contributed equally to this work by participating in the conceptualisation, data collection and analysis, as well as in the writing of the manuscript. Pérez-Ramos supervised the project and critically reviewed the manuscript prior to submission.

Availability of data and materials

The data used during this study are not publicly available, however, they are available upon reasonable request to the corresponding author.

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Abbreviations

INEGI	National Institute of Statistics and Geography
OIT	International Labour Office
ONU	United Nations

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Journal Economic Systems 8[14]1-9: e40814109
Article

The relationship that exists between market analysis and sales management carried out by microentrepreneurs in Santa Cruz de Juventino Rosas, Gto

La relación que existe entre análisis de mercado y la gestión de ventas que llevan a cabo los microempresarios de Santa Cruz de Juventino Rosas, Gto

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Abstract

This article is the result of a research study aimed at identifying the relationship between market analysis and sales management among micro-entrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato. This was done through a statistical correlation, using Pearson's correlation coefficient with data from a sample of 593 micro and small enterprises, applying the quantitative research method, transversal exploratory, in which the relationship between market analysis and sales management of the micro-entrepreneurs was analyzed. The following hypotheses were defined: H0: there is no relationship between market analysis and sales management of the micro-entrepreneurs in Santa Cruz de Juventino Rosas, Gto., and H1: there is a relationship between market analysis and sales management of the micro-entrepreneurs in Santa Cruz de Juventino Rosas, Gto. With a Spearman's Rho of 0.314 and a significantly small p-value, the correlation between both variables was confirmed, validating hypothesis H1. It is concluded, therefore, that there is indeed a relationship between market analysis and sales management.

Objetive	Methodology	Contribution
Research study aimed at identifying the relationship between market analysis and sales management among micro-entrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato.	This research was carried out under a quantitative approach, considering a correlational and cross-sectional design.	The existence of the relationship between sales management and market analysis in microentrepreneurs of Santa Cruz de Juventino Rosas, Gto. was demonstrated.

Market analysis, micro entrepreneurs, sales management

Resumen

El presente artículo es el resultado de un trabajo de investigación, que tiene como objetivo identificar la relación que existe entre el análisis del mercado y la gestión de ventas de los microempresarios de Santa Cruz de Juventino Rosas, Guanajuato, la cual se realizó mediante una correlación estadística utilizando el coeficiente de correlación de Pearson, considerando una muestra de 593 micro y pequeñas empresas, aplicando el método cuantitativo de investigación, transversal y exploratorio, en el que se identificó la relación que existe entre el análisis del mercado y la gestión de ventas de los microempresarios. Se definieron las siguientes hipótesis, H0: no existe relación entre el análisis del mercado y la gestión de ventas de los microempresarios de Santa Cruz de Juventino Rosas, Gto. y H1: existe relación entre el análisis del mercado y la gestión de ventas de los microempresarios de Santa Cruz de Juventino Rosas, Gto. Obteniéndose como resultado una Rho de Spearman de 0.314 y un p-value significativamente pequeño, se comprobó la correlación entre ambas variables, validando la hipótesis H1. Se concluye entonces que sí existe una relación entre el análisis de mercado y la gestión de las ventas.

Objetivo	Metodología	Contribución
Identificar la relación que existe entre el análisis del mercado y la gestión de ventas de los microempresarios de Santa Cruz de Juventino Rosas, Guanajuato.	Esta investigación se realizó bajo un enfoque cuantitativo, considerando un diseño transeccional de tipo correlacional y corte transversal.	Se demostró la existencia de la relación entre la gestión de ventas y el análisis de mercado en los microempresarios de Santa Cruz de Juventino Rosas, Gto.

Análisis de mercado, gestión de ventas, mypes

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Introduction

Today's business world is changing at a rapid pace. Therefore, the intelligent and reasoned use of information derived from market analysis by entrepreneurs is essential to keep pace (Malhotra, 2008).

This poses great challenges for the SME ecosystem, among which is the management of effective sales by this category of business. Management begins when a potential customer's attention is captured and ends in the concrete action of a sale of the goods and services offered by a company (Valdés, 2017). This makes it possible to identify the patterns or trends of its customers, implementing specific strategies that respond to their needs, tastes or preferences, thus improving its positioning in the market.

On the other hand, the sales manager is the person who assumes personal responsibility for ensuring that each of the stages of the process are carried out on time. It is therefore advisable to make a sales plan in order to fulfil all the stipulations. Therefore, proper sales management should find new opportunities, make sales forecasts, manage reports and appropriate techniques. All these tasks will help those involved to achieve their objectives (Quiroga, 2021).

It can be seen from the review of the state of the art that it is important to identify how market analysis is connected to the sales management performed by microentrepreneurs in the above-mentioned context.

The present study refers to the research carried out in the municipality of Santa Cruz de Juventinos Rosas, Guanajuato, where 3,295 micro and small enterprises are located (INEGI, 2024), information was collected from 593 small and medium enterprises, to answer the question: Is there a relationship between market analysis and sales management of microentrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato?

Literature Review

Small businesses acquire special importance for the economic and social structure of the country as they are immersed in a new globalising context, as they face new problems, new challenges, which oblige them to adopt or develop new action alternatives in order to be able to remain and join competitive markets. The effective management of small enterprises (SEs) can detonate the country's potential for social and economic well-being and development.

Undoubtedly, SMEs play an important role in the global economy, and their participation is becoming increasingly important given their dynamism and simplicity in carrying out activities that generate income and resources, which in turn can be reinvested and lead to the strengthening of enterprises. Valdés & Sánchez (2012) consider that the necessary elements of an enterprise are: capital, labour, land and entrepreneurial skills, aspects that allow the objective to be achieved through the manager's decision-making.

According to the Economic Commission for Latin America and the Caribbean (ECLAC, 2016), SMEs represent about 99% of the total number of companies and generate about 67% of jobs, thus constituting a relevant component of the productive scaffolding in the region and key actors to increase the potential growth of Latin America.

On the other hand, according to the Foundation for the Strategic Analysis and Development of Small and Medium Enterprises, the benefits perceived by companies, derived from the adoption of sustainable policies in the business, are related to the improvement of the image and reputation, the increase in the degree of customer satisfaction, the generation of advantages over the competition, the increase in the profitability of the company or the increase in the motivation of employees (Guardado, 2023).

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Sales management is efficient as long as these four objectives are met, such as: control in sales procedures, sales planning, hiring competent personnel and training the team (Johnston & Marshall, 2009). Arteaga & Molina (2022), state that sales management is a dynamic process where different elements interact and contribute to the sale being made, with the premise of satisfying the customer's needs. All the driving forces of an organisation must be brought together, as they are an important source for achieving the objectives, this process starts from the first contact with the customer and it will depend on the business strategies whether or not a sale is closed. Guadarrama & Rosales (2015) mention that customer relationship management is one of the strengths of management today, since knowing the needs, preferences, tastes and capabilities of the consumer leads to the development of a communication system in order to generate information to make decisions that benefit both parties.

Sales management is a dynamic process where different elements interact and contribute to the sale being made, with the premise of satisfying the customer's needs. Likewise, Torres (2014), quoted by Díaz, Salazar & Vernaza (2019), mention that it also involves administrative, strategic, tactical or operational procedures or activities. In sales management, a distinction is usually made between retail and wholesale. The former consists of the activities necessary to sell goods or services to final consumers for their own consumption. The latter consists of wholesale sales, which are purchased for resale or for business, industrial or institutional uses. According to the type of distribution channel, strategies of product, price, place, promotion, people, processes and physical elements that meet the customer's expectations must be complemented.

Sales management focuses on the performance of the members of a company, who support the achievement of objectives, including economic ones. For this, performance evaluations must be carried out, which reflect the results obtained by the participating personnel, as well as their contribution to the achievement of the established goals; otherwise, when there is poor sales management, this is reflected in the results of the organisation, which can influence inadequate decision making.

Jobber & Lancaster (2012) mention that it is a simple way of thinking about the role of sales, but it really disguises a process that is sometimes complex, as it encompasses principles, skills and techniques that are essentially personal.

Albarracín, Jalon & Martínez (2022), emphasise that, in order to access the market, sales tactics must be developed that guarantee the achievement of planned estimates, adding that sales management is a whole process that a company generates in order to increase its market share through these strategies.

Today, the sales representative plays a much more strategic role by participating in the company's planning, including sales forecasting activities, budgeting, marketing aspects, among others, in order to ensure that all activities are integrated into the process.

The relationships with the customer that are carried out in SMEs are different in comparison with large companies, considering that the marketing of small companies has been characterised by being casual, informal, unstructured and spontaneous, this spontaneity with which the marketing process is carried out in SMEs, allows to show the type of relationship that is generated within these organisations, which often do not know how to treat consumers to turn them into profitable customers and not into customers that only generate a transaction. Peppers & Rogers (2006), cited by Guadarrama & Rosales (2015) suggest that giving value to the customer allows obtaining value from customers, but that efforts should not be spent on the most loyal customers, but on the most profitable ones.

While market research captures what consumers want them to hear, market analysis will help identify patterns or trends. Both approaches can be used to validate that the data match, i.e. the analysis reflects the research and vice versa.

In many cases, MSEs are preoccupied with generating a transaction, leaving aside the issue of marketing, which is fundamental to any business.

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Regardless of the size of the company (micro, small or medium), the issue of marketing and customer-oriented relationships are of utmost importance, since it is through these that customer information can be collected for segmentation, and with this, differentiation value can be generated, and therefore, customer profitability can be managed.

Within the productive and commercial activity of goods and services, there are factors that influence the realisation of a project such as: the client, the competition, the prices, the commercialisation and the marketing plan that will be applied to increase the volume of sales. The study of these variables takes the name of market research, which encompasses the collection, recording, processing and analysis of information, which when interpreted will serve to discover opportunities and reduce risks in decision-making.

Consumer analysis seeks to identify consumer preferences, consumption habits and unsatisfied needs, in order to obtain a profile on which the commercial strategy can be based in order to know the quantity of goods that the consumer is willing to purchase.

Fischer & Espejo (2016) mention that it is important that company managers adopt systematic procedures to collect ideas or information from the environment for the generation of new products, the reasons why sometimes they are not successful when they are launched to the market must be taken into account, among the different aspects to consider are the price, an inadequate analysis of the market, product defects, competition, product distribution, etc.

Kotler & Armstrong (2016) states that in the first place companies decide what to offer, including the product and price, followed by how to offer, i.e. the place and promotion; the place where to distribute the product must be determined in order to make it more accessible to the market. Companies must also communicate information about the product or service to the target audience using different methods, including advertising, public relations and sales promotions.

He highlights the fact that there is a difference between sales and marketing and states that many companies focus on achieving the fundamental objective of increasing sales in the short term, but in the medium and long term they fail to achieve marketing objectives, such as maintaining continuous sales growth and increasing market share, making profits on sales and other indicators that actually measure success in marketing management.

Zapata, E. (2001) cites research carried out in the United States (Indiana, Michigan and Illinois), which was based on Philip Kotler's theory, with a sample of 177 small, medium and large companies, defining that marketing activity is directly proportional to the size of the company, i.e. the larger the company, the greater the marketing activity. The main objective of Kotler's article is to propose a way of determining whether a company assimilates and practices marketing and, if so, how well it does so. He states that it is not so simple to establish marketing effectiveness, since a company can obtain good sales results as long as it is in the right place at the right time, without this meaning that it has been the product of effective marketing management, and, on the contrary, have poor results despite having carried out excellent marketing management.

Thus, market orientation can be defined as the set of efforts that companies make to create value in target markets.

Slater & Nerver (1998) defined market orientation as the organisational culture that most effectively and efficiently creates the behaviours necessary for the provision of superior value. For buyers it is the generation of market information, dissemination of firm information and firm responsiveness.

Effectiveness has been generally understood as the achievement of objectives, but Arias (1988) emphasises that a very important precision must be made: effectiveness must be understood as the degree to which objectives are achieved, given that two organisations that achieve their objectives could be classified as effective, but if one of them achieves its objectives to a greater degree, the truth is that it must be considered more effective than the other.

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Efficiency is conceptualised as the ratio between the objectives achieved and the resources used to achieve them. An organisation may achieve its objectives, but using fewer resources than others and therefore could be categorised as more efficient. Drucker (1979) in defining these concepts is referring to the management of a company as a whole. Different functions are performed in the company: administration, marketing, finance, production and research and development (usually only in large companies). The manager's administrative task is to achieve the overall effectiveness of the organisation, which will be possible if effectiveness and efficiency is achieved in each particular area.

In marketing theory, several definitions of marketing are known, which include an explicit reference to marketing effectiveness.

Marketing enables MSEs to effectively communicate the value of their goods and services, thus generating repurchase and increasing profitability. But this function of marketing within MSEs is hampered by limited access to resources and a lack of training or prior knowledge of marketing on the part of the business owner or manager. It is recognised that the owner of an MSE is committed to marketing activities, but in reality the way they are implemented is not done properly.

Methodology

This research was conducted under a quantitative approach, considering a cross-sectional, correlational, cross-sectional design (Hernández, Fernández & Baptista, 2014).

The variables considered for the study are, in terms of market analysis: price, product quality, customer knowledge, quality of customer service and strengths and weaknesses of the competition, and in terms of sales management, activities to detect and add new customers have been considered; in order to know the relationship between them.

Using Pearson's correlation coefficient, the following research question was determined: Is there a relationship between market analysis and sales management of microentrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato?

For which the following hypotheses were defined H0: there is no relationship between market analysis and sales management of microentrepreneurs in Santa Cruz de Juventino Rosas, Gto. and H1: there is a relationship between market analysis and sales management of microentrepreneurs in Santa Cruz de Juventino Rosas, Gto. The data considered to carry out the corresponding analysis is the result of the application of 593 questionnaires to microentrepreneurs. From the instrument that was applied, the market analysis and sales management were considered. The variables analysed for the study are the market analysis considered as a dependent variable, including: price, product quality, customer knowledge, quality of customer service and the strengths and weaknesses of the competition, and the sales management as an independent variable, mainly considering the activities to detect and add new customers. Both variables with response options on a 5-point Likert scale.

A maximum sampling error of 5.0 % and a confidence level of 95.0 % was considered. A sample of 593 questionnaires was defined, which were applied to the directors of the mypes of Santa Cruz de Juvetino Rosas. They were randomly selected to form a sample of MSMEs with different activities or business lines. This type of sampling allows us to test the hypotheses and obtain sufficient data to achieve the research objective. The statistical analysis of the data was carried out using Minitab 2016 and SPSS software.

The reliability of the research was determined by applying Cronbach's alpha statistical method, as shown in table 1, obtaining internal consistency in the results, according to Nunnally & Bernstein (1994).

Box 1

Table 1

Alpha de Cronbach

Alpha de Cronbach
.869

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Results

In order to select the optimal strategy for the statistical analysis, the process was started by performing a normality test on both constructs, which allowed determining the best methodological approach for Market Analysis and Sales Management.

The Kolmogorov-Smirnov and Shapiro-Wilk tests were performed. In the case of the Market Analysis construct, the results presented in table 2 showed very low values for the significance level of both tests. This finding indicates that it is very likely that the distribution of the data is not normal.

Box 2

Table 2

Normality Test for Construct 10

Constructor 10	Kolmogorov - Smirnov		Shapiro-Wilk	
	Statistician	Sig.	Statistician	Sig.
	.163	.000	.867	.000

This evidence is strengthened by looking at the visual distribution of the information, which does not follow a normal pattern:

Box 3

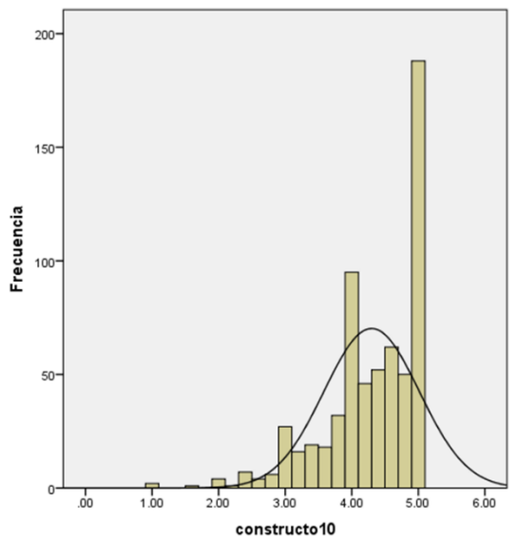

Figure 1

Market Analysis Distribution

Source: Own elaboration

In the case of the Sales Management construct, normality tests also showed very low values for the significance level.

As in the previous construct, this suggests that it is very likely that the data set does not fit a normal distribution.

Box 4

Table 3

Normality Test for Construct 13

Constructor 13	Kolmogorov - Smirnov		Shapiro-Wilk	
	Statistician	Sig.	Statistician	Sig.
	.089	.000	.950	.000

Graphically it can be seen that it does not follow the shape of a normal distribution, clearly marked by the normal line.

Box 5

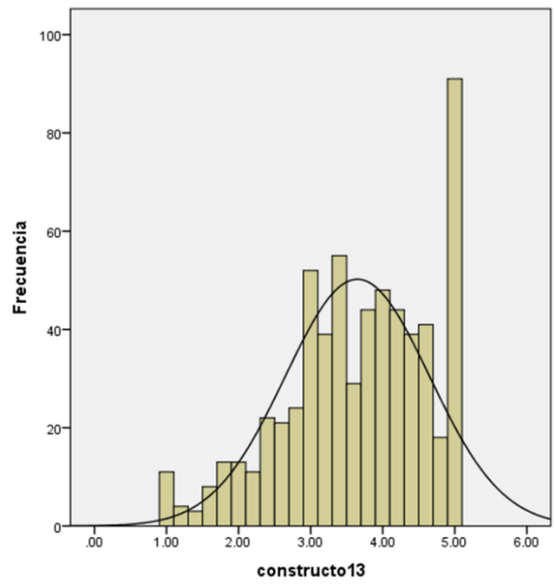

Figure 2

Distribution of Sales Management

Source: Own elaboration

For both constructs it was found that they are data sets that do not follow a normal distribution, so the statistical analysis must be done with non-parametric tests.

The next step is then to show whether or not there is a relationship between the two constructs and how strong this relationship is.
In the case of non-parametric tests and when two ordinal variables are being considered, the most appropriate test is the application of Spearman's correlation.

This calculation was carried out using the SPSS software, obtaining the following results:

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Box 6

Table 4

Spearman correlation			Constr. 10	Constr. 13
Spearman	Constr. 10	Coef.	1	**.314**
		Sig.		.000
	Constr. 13	Coef.	**.314**	1
		Sig.	.000	

The correlation table yields several results. Firstly, the significance level is so low that it is not computable, and is presented as 0.000, which puts the value below 0.05, which is the level of comparison. This means that there is indeed a relationship between the two constructs, and that it is statistically significant.

Also, the Spearman correlation value of 0.314 shows that there is a relationship between the two constructs. This value is indicative of a positive relationship of moderate level.

Conclusions

The objective of this research was to identify the relationship between market analysis and sales management of microentrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato. The application of 593 questionnaires to these micro-entrepreneurs was carried out, and the following hypotheses were put forward:

H0: there is no relationship between market analysis and sales management of microentrepreneurs in Santa Cruz de Juventino Rosas, Gto. and H1: there is a relationship between market analysis and sales management of microentrepreneurs in Santa Cruz de Juventino Rosas, Gto. Market analysis was considered as the dependent variable and sales management as the independent variable.

A normality test was carried out which showed that both sets of information do not follow a normal distribution, therefore, it was decided to carry out non-parametric tests.

Subsequently, in order to determine the possible correlation between the data, Spearman's Rho was calculated by bivariate analysis, obtaining as a result a p-value of less than 0.05, which is evidence to confirm the acceptance of Hypothesis 1, and to determine that there is a correlation between the data. This value indicates a statistically significant relationship between the variables.

Spearman's coefficient also indicated that the correlation is moderate due to its value of 0.314. The data analysed above were obtained from the results of the RELAYN database (2024).

Declarations

Conflict of interest

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

Author contribution

The contribution of each researcher in each of the points developed in this research, was defined based on:

Valdez-González, María Isabel: Contributed to the research design, the systematization of the background for the state of the art. She also contributed to the writing of the article.

Cano-Ramírez, Eliseo: Contributed to the research design, the type of research, the approach, the method and the writing of the article. He also carried out the data curation.

González-Escoto, Claudia: Contributed to the research design, the type of research, the approach, the method and the writing of the article.

Availability of data and materials

The statistical information comes from the results of the RELAYN database (2024), which can be found in the References section.

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Article

A strategy to enhance decisions in logistics and transportation companies

Una estrategia para potenciar decisiones en empresas de logística y transporte

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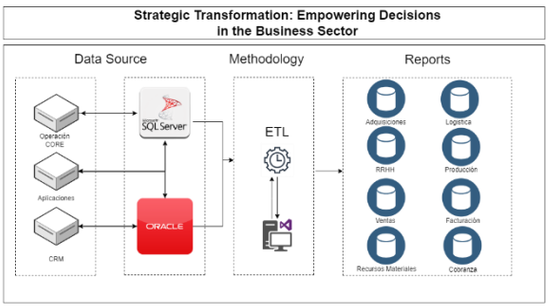
Abstract

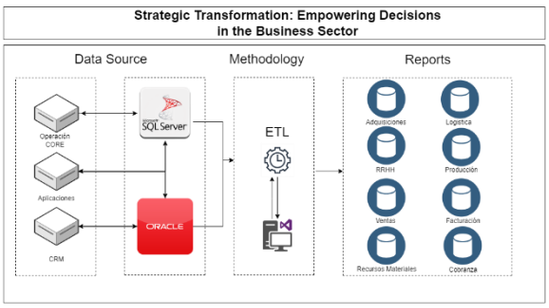
Currently, automated computing tools are necessary allowing controlling the design, development, and implementation of processes aimed at making intelligent decisions in real-time in logistics and transportation companies. Although these types of tools currently exist, they show shortcomings that are addressed here, such as the precise use of large volumes of information with a comprehensive, tailored platform. Here is proposed a method that includes requirements analysis, database design, implementation, testing, training, and deployment. This proposal is intended to provide business intelligence and provide benefits such as greater visibility over operations to create automated decision-making workflows throughout the customer lifecycle



Data science; Logistics-&-Transportation; strategy

Resumen

En la actualidad son necearías herramientas de cómputo automatizadas que permiten controlar el diseño, desarrollo e implementación de procesos orientadas a la toma de decisiones inteligentes en tiempo real en empresas de logística y transporte. Si bien este tipo de herramientas existen actualmente muestran deficiencias que aquí se abordan, como el aprovechamiento preciso de grandes volúmenes de información con una plataforma integral hecha a la medida. Aquí se propone un método que incluye análisis de requerimientos, diseño de base de datos, implementación, pruebas, capacitación y despliegue. Se pretende que esta propuesta brinde inteligencia de negocio y proporcione beneficios, como una mayor visibilidad sobre las operaciones para crear flujos de trabajo de toma de decisiones automatizadas a lo largo del ciclo de vida del cliente.



Ciencia de datos; Logística y Transporte; estrategia

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Introduction

In the dynamic environment of logistics and transportation, decision-making plays a crucial role in the operational success of companies. As global trade expands and supply chains become more complex, the need for data-driven decisions has become more imperative than ever. Optimizing these processes not only streamlines operations but also reduces costs, minimizes delays, and enhances customer satisfaction.

To achieve these improvements, companies employ various strategies, many of which are supported by advanced technologies. Tools such as artificial intelligence (AI) [I], machine learning, and big data analysis allow for more accurate demand forecasting, route optimization, and real-time inventory management. Additionally, automation in warehouse management and transportation helps reduce human error and increase operational efficiency. Predictive analysis, in turn, helps anticipate disruptions in supply chains, allowing companies to take preventive measures to mitigate risks.

Sustainability has also become increasingly important in modern logistics. In response to growing environmental concerns, many companies are adopting more sustainable practices, such as optimizing fleets to improve fuel efficiency and reduce carbon emissions. These environmentally-friendly initiatives not only align with global sustainability goals but also enhance corporate reputation and ensure regulatory compliance.

Therefore, the integration of technological innovations and sustainable practices is key for logistics and transportation companies to maintain their competitiveness in an increasingly dynamic and customer-focused market.

Background.

Utilization of Advanced Analytics and AI: Companies can employ advanced analytics and AI to gain insights from big data which helps in optimizing routes, predicting demand, managing risks, and automating various tasks [I].

Integration of Transportation Management Systems (TMS): Implementing a TMS can streamline logistics operations by providing real-time visibility into the supply chain, simplifying the planning and execution of transport tasks, improving shipment tracking, and facilitating better communication among stakeholders [II].

Adoption of Internet of Things (IoT): IoT devices can track goods in transit, monitor the condition of cargo, and collect data on vehicle performance. This data can be used to enhance decision-making regarding maintenance schedules, route planning, and load optimization [III].

Sustainability and Green Logistics: In [IV] it is proposed that Incorporating eco-friendly practices and technologies such as electric vehicles, alternative fuels, and energy-efficient warehouse operations can help companies meet regulatory requirements, reduce emissions, and enhance brand reputation. In the logistics sector, it is proposed an innovative decision support model for the development of zero-emission transportation modes [V].

Collaboration and Integration: Collaborative logistics strategies, including sharing assets and data with other companies and integrating various supply chain operations, can lead to cost reductions and better service levels. Collaborative transport networks can also help in route optimization and load consolidation [VI].

Blockchain Technology: Blockchain can enhance transparency and security in the supply chain by providing immutable records of transactions. This can lead to better traceability of goods, reduction in fraud, and improved trust among supply chain stakeholders [VII].

This use case focuses on a private company in the logistics and transportation sector, which implies that it does not receive public funding. To safeguard the company's information, the research refrains from disseminating data classified as critical and sensitive.

This use case focuses on a logistics and transportation company whose daily operations generate a large amount of data.

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However, this data is primarily used for internal tracking of specific processes, without leveraging its full strategic potential. Although the company has a considerable amount of valuable information, it has yet to develop a comprehensive vision that integrates and analyzes the data generated at each stage of the process. This means that, despite having access to potentially useful knowledge, it is not being effectively utilized to make informed decisions and improve the organization's overall performance.

The ability to extract valuable knowledge from data should not be considered merely an operational tool but a fundamental strategy for achieving business success [VIII]. In this context, Key Performance Indicators (KPIs) implicitly refer to the development of specific metrics used to evaluate the performance of processes, projects, or departments within the company. The purpose of implementing these indicators is to measure and obtain relevant information. Using KPIs provides senior management with a quick and comprehensive view of the overall state of the business [IX]. Additionally, they provide a quantifiable measure of performance in critical areas of the business, allowing business leaders to make informed decisions and make strategic adjustments when necessary [X].

During a statistical study conducted in each area that constitutes the complete cycle of the logistics and transportation company's operations, it was determined that relevant information is omitted between each process, causing the repetition of activities. This implies that a significant amount of valuable data is not being utilized to improve and streamline processes. Therefore, if the logistics and transportation company effectively integrates and analyzes the data generated at each stage of the process, it will be able to identify areas for improvement, optimize its operations, and increase its overall performance.

This work aims to offer an integrated information system that facilitates informed decision-making. Additionally, it seeks to enable the end user to resolve their queries through a centralized system, using natural language questions without technical jargon. In this way, reports that add value to daily operations can be generated.

Methodology

The case study for this research was developed at the company “Logística y Transporte S.A. de C.V.” This section focuses on the key elements that guided the development of this research, starting with the preliminary analysis, the design of a database, the programming of scripts for data extraction, and culminating with the integration of a technological tool that enables the interpretation and controlled dissemination of the resulting information.

Data Source

The company “Logística y Transporte S.A. de C.V.” has an organizational structure based on its successful experience, resulting in few structural changes over time. The implemented technology consists mainly of two independent information systems. This architecture causes the availability of information to depend on the technical characteristics of each data source, as well as the operational activity during the query. While the database structure is relational, it is not efficient enough to generate real-time reports that allow for the identification and measurement of key business factors. Having a reliable, integrated, and readily available source of information is highly efficient for an organization, as it significantly enhances informed decision-making [XI].

Database Design

During the database design process, a key activity was to classify the information from each system within the company. This resulted in a unique and comprehensive data schema. Identifying key areas and decision points improved data quality, which in turn facilitates report generation. The data model developed is based on a micro services architecture [XII]. The database is composed of related tables, and data ingestion is performed by replicating relevant information from the operational databases. This replication ensures data availability in each system. Additionally, the design is scalable to adapt to operational demand.

Data Ingestion ETL

Centralized storage is managed through the ETL process, which stands for Extract, Transform, and Load data [XIII].

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This process is essential for integrating data from various sources within the organization. During the extraction phase, information is gathered from different operating systems; then, in the transformation phase, the data is cleansed and structured according to business requirements; finally, in the loading phase, the data is stored in a central database. The design of this receiving database has been specifically optimized to convert raw data into useful and actionable information, enabling the organization to enhance decision-making and generate accurate reports efficiently.

In a technological capacity study conducted at "Logística y Transporte S.A. de C.V.", it was identified that the organization generates an average of 5 million records over a 30-day period. The data ingestion process is crucial to ensure that relevant information is available in a timely and accessible manner. This process includes the creation of queries specifically designed to transport the information to its destination through scheduled tasks Figure 2.

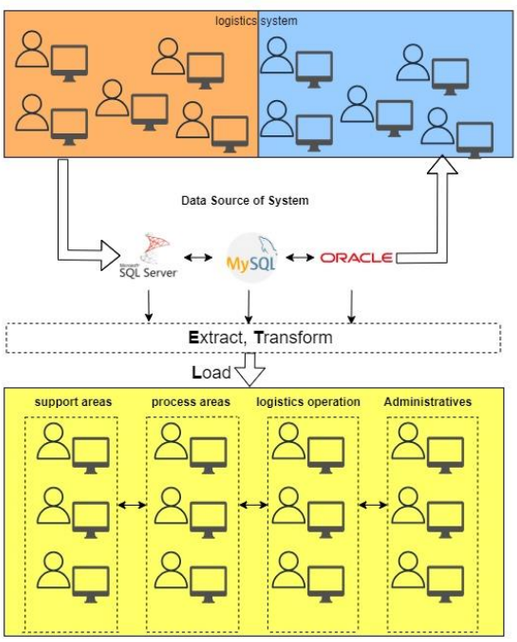

Figure 2 Transformation and Organization of Data.
This figure illustrates the transformation and organization of data from different information sources, using the ETL process.
This chart was created in Draw.io 2024

Reports Business Intelligence

In this work, the concept of business intelligence is based on the integration of Key Performance Indicators (KPIs), which are essential metrics for measuring and evaluating the success of an organization or project. Business intelligence not only focuses on gathering these indicators but also leverages them as critical tools to optimize decision-making and improve operational efficiency. Through the analysis and interpretation of KPIs, the goal is to transform large volumes of data into practical and actionable knowledge, allowing the organization to adjust its strategies, identify opportunities for improvement, and achieve its objectives more effectively [XIV]. This approach turns information into a strategic resource for guiding decisions at all levels.

The company ***"Logística y Transporte S.A. de C.V."*** generates an average of 7.5 million records per month. Attempting to analyze this data without an appropriate methodology and expecting a favorable outcome presents a monumental challenge that requires a multidisciplinary team. So far, the research has resulted in a database structured by business line, where the data is coherently grouped and related. This organization of information facilitates the implementation of Key Performance Indicators (KPIs), which are considered essential management tools to support decision-making. These KPIs are not only based on operational standards and norms but also enable the organization to project its future by providing a clear view of its current performance and areas for improvement [XV]. This effort significantly contributes to the organization's ability to adapt to changes and seize opportunities in its operational environment.

The database structure designed in this project is organized into four main groups: Support Areas, Process Areas, Logistics Operations, and Administration Areas. The KPIs implemented with this new data model are both strategic and operational. This organization provides the necessary information to guide the company's daily operations and facilitates the adoption of preventive measures that improve productivity and efficiency in the corresponding areas.

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Strategic KPIs

This level of indicators provides the organization with essential information for planning and setting achievable goals. Additionally, it enables real-time monitoring of the processes being evaluated, offering a clear and robust view of the current situation. This perspective not only facilitates informed decision-making but is also flexible enough to adapt to necessary changes and adjustments, ensuring that the organization can effectively respond to environmental dynamics and maintain its competitiveness.

Operational KPIs

Measuring the efficiency of the value chain in a company's operations is crucial for understanding its capacity to meet customer needs. This evaluation not only helps identify areas for improvement but also optimizes processes. Therefore, it is essential to promote collaborative practices that strengthen sustainability among suppliers. In this project, the implementation of a dashboard that centralizes information on customer requirements was proposed [XVI]. By establishing strong relationships and working together, companies can enhance their operational efficiency while also contributing to more sustainable development throughout the value chain. This approach benefits not only the organization but also creates value for all stakeholders involved, fostering a more resilient environment that aligns with market demands. In the case of *"Logística y Transporte S.A. de C.V."*, the company not only has a standardized system for its processes, but thanks to the implementation of Key Performance Indicators (KPIs) Figure 3. It can now assess whether these processes are truly effective or if adjustments are required. The proposed objectives, in addition to being measurable, are continuously monitored through the integration of these indicators.

These Key Performance Indicators enable the company to identify areas for improvement, ensuring that its operations remain aligned with customer expectations and the organization's strategic objectives.

Selection of Tools

To date, a database specifically designed for report generation has been implemented, offering a scalable, reliable, and secure model.

This database is complemented by the integration of Key Performance Indicators (KPIs), providing a detailed and comprehensive view of the business, while incorporating the Fine-Tuning of each company process. The solution is precisely tailored to accommodate the specific, non-repetitive cases that arise within the company, which lack predefined algorithms or cyclical patterns.

Although the information is already organized in a format suitable for analysis, the true competitive advantage lies in the incorporation of a business intelligence tool capable of interpreting and visualizing relevant data clearly and in real-time. This tool allows users to make informed decisions swiftly by providing them with an instant overview of trends, KPI performance, and other critical aspects of the business.

This approach not only optimizes access to information but also facilitates the transformation of raw data into actionable insights. This process is essential for strategic decision-making, especially in a dynamic business environment where the ability to quickly adapt to changes is crucial for maintaining competitiveness and ensuring sustainable growth Figure 3.

The process of selecting an appropriate tool for the model proposed in this research faced a primary limitation: cost. In a business with approximately two hundred key users, a significant investment is required due to the high availability and licensing needed for each user. The technological infrastructure proposed to support this model includes:

- Primary MS SQL Database Server.
- Secondary MS SQL Database Server (for high availability)
- Storage
- Business Intelligence (BI) Web Server

These components are essential to ensure that the business intelligence tool operates efficiently, providing the necessary resources for real-time data analysis and visualization.

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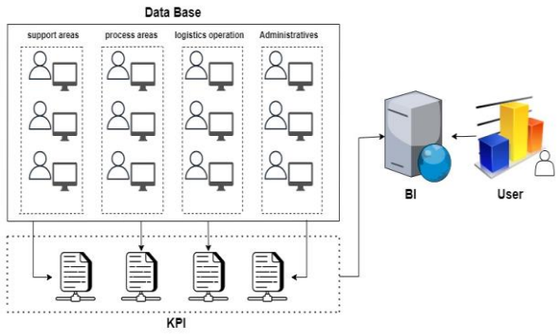

Figure 3. Implementation of Key Performance Indicators (KPIs).
The presented chart illustrates the integration of the new data model with Key Performance Indicators (KPIs), both connected to the web-based business intelligence (BI) tool. This integration facilitates the generation and presentation of visual reports to the end user in the form of graphs and trend analyses.
This chart was created in Draw.io 2024.

Metabase

Is a Business Intelligence tool that stands out for its practical and accessible user interface, designed to facilitate the creation of graphical reports even for users with limited database knowledge. This platform allows users to generate data visualizations intuitively and efficiently, without requiring advanced technical skills. Access to Metabase is through a web browser, which simplifies the distribution of reports and dashboards directly online, ensuring that results are quickly and easily available to all members of the organization.

One of the standout features of Metabase is the inclusion of report automation modules, which can be scheduled to automatically send reports via email to the appropriate recipients. This functionality is particularly useful for keeping teams informed with up-to-date information without the need for constant manual intervention.

Metabase has gained popularity, especially among micro and medium-sized enterprises, due to its low implementation cost and its ability to process and visualize information effectively. Despite being an open-source tool distributed under the GNU AGPLv3 license, Metabase also offers assisted services and infrastructure options for those who require additional support or more robust environments.

In the specific case of the company "Logística y Transporte S.A. de C.V.", the V1.50.19 Open Source Edition has been implemented on a physical server that exceeds the manufacturer's recommended specifications. This configuration allows the company to fully leverage the tool's potential, ensuring optimal performance in data processing and analysis.

Advantages

One of the main advantages of Metabase is its user interface, which is not only intuitive but also remarkably simple. This simplicity significantly reduces the learning curve for end users, allowing them to start working with the tool quickly and efficiently, without the need for extensive technical training.

Moreover, Metabase stands out for its native integration capability with a wide range of database engines. Among the most important are MS SQL, PostgreSQL, MySQL, and Oracle. This compatibility facilitates a direct and seamless connection with existing databases, enabling the organization to leverage its current infrastructure without the need for complex adjustments. This simplified integration approach is particularly valuable, as it enhances decision-making based on accurate and up-to-date information.

Dashboard

This section presents the final stage that integrates all the activities carried out in this project, consolidating key information into a comprehensive control center. It acts as a centralized platform that provides decision-makers with a complete and detailed view of operations. Through this panel, all critical information is presented clearly and concisely, enabling an immediate and accurate assessment of the current situation.

For the company, the dashboard is a strategic tool that facilitates the identification of trends, the anticipation of issues, and informed decision-making. By integrating different areas and processes, it offers a holistic perspective that is essential for effective planning and continuous operational improvement.

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The first dashboard implemented at *"Logística y Transporte S.A. de C.V."* was named: *Control de Operaciones Logísticas*. This tool was designed to provide an operational overview based on the systematic comparison between process inputs and outputs. By incorporating time-based statistical data, it allows the administrator to accurately assess operational performance and determine the necessary adjustments to optimize workflow. Although this initial model does not cover all operational processes, its impact has been significant since its implementation. It has proven essential in daily monitoring and management, facilitating more agile and informed decision-making. The adjustments and changes made in the operation have been directly derived from the information provided by the ***"Control de Operaciones Logísticas,"*** which has become a crucial component in complementing and improving the company's daily activities.

Conclusions

In a digital and highly competitive era, companies are faced with the imperative need to have tools that complement and strengthen their organizational strategy. From its inception, this project presented various challenges, particularly in identifying and highlighting areas of opportunity within key processes. Before the implementation of a unified information dashboard, the only way to assess the results of a process was to wait until its completion. This meant that aspects such as the time invested and the collaborative effort were poorly understood, and that objectives were planned continuously but with unforeseen changes.

The implementation of a database system independent of the company's main systems has proven to be highly efficient. The information analyzed today is not only presented in real-time but is also supplemented with data from related processes, thanks to a data model designed to integrate all information through unique identifiers. This allows for timely decision-making to ensure the established service levels are met.

The design, development, and implementation of this research resulted in a significant increase in processing capacity at the main distribution center of "Logística y Transporte" S.A. de C.V. The primary focus of this document was the material reception area, as this is where the process begins. Prior to this project, operational results were analyzed every 30 days; now, this supervision is conducted daily, leading to greater efficiency in this initial but crucial process.

I conclude that a company's competitiveness is directly related to its ability to monitor each of its processes from an analytical perspective, with the aim of making precise and meaningful decisions. The success of this project lies not only in the integration of data and technical aspects but also in the collaboration of people willing to contribute and adopt new performance indicators.

Conflict of interest

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

Author contribution

José Luis Castro Benitez, a master's student, works at "Logística y Transporte S.A. de C.V." and directly experiences the needs of the company. He is the one who proposes a data-driven solution based on the organization's information.

Victor Miguel Hernández Maldonado contributed with his expertise in managing large volumes of data and provided valuable guidance in the development of tools that could serve the practical purposes this work aims to achieve.

Abbreviations

AI (Artificial intelligence)
BI (business intelligence)
ETL (Extract, transform, and load)
KPI (key performance indicator)
IoT (Internet of Things)
MySQL (My Structured Query Language)
SQL (Structured Query Language)

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Article

Classroom sanitizing robot

Robot sanitizante de aulas

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Abstract

With the sanitizing robot project for classrooms, where nowadays a problem faced by the population is the health crisis generated since 2019 called COVID-19, considering that in this year 2024, with a new wave, measures in face-to-face classes only involve protocols for applying hand sanitizer and wearing masks, without taking into account the time spent inside the classrooms, which is almost the entire day Therefore, if a sanitizing robot controlled by Arduino through a mobile application is developed to disinfect the classrooms of the mechatronics engineering program in Building F at the Technological Institute of Higher Studies in Jilotepec, it can be controlled via a mobile phone using Bluetooth and sanitizes using a 360° rotating nozzle to reach all areas, while also having an obstacle detection sensor to prevent collision.

Sanitizer, Arduino, Mobile application

Resumen

Con el proyecto del robot sanitizante de aulas, donde hoy en día un problema que se enfrenta la población es la crisis sanitaria generada a partir del 2019 llamada COVID-19, considerando la llegada de un repunte en este 2024 con las clases presenciales ya no se toman protocolos de aplicación de gel antibacterial y cubrebocas sin tomar en cuenta el tiempo de estancia dentro de las aulas que es de casi todo el día, por lo tanto si se realiza un robot sanitizante controlado con Arduino por medio de una aplicación móvil para desinfectar las aulas de la carrera de ingeniería mecatrónica del edificio f del tecnológico de Estudios superiores de Jilotepec. Se controla por medio de un teléfono móvil por medio de bluethooth y sanitiza mediante una pistola que gira 360° para poder alcanzar todas las áreas, pero también cuenta con un sensor detector de obstáculos para evitar pueda golpearse.

Sanitizante, Arduino, Aplicación móvil

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Introduction

The robots are considered intelligent tools that have allowed automation and with this allow the replacement of human labour by automatons can perform more efficient and faster work in conditions and environments that for humans would be inaccessible or dangerous therefore with the project of a classroom sanitizing robot, has the purpose of performing quickly and safely in the classrooms of the building F of TESJI, to provide an efficient and accessible solution, therefore we can find the different parts of the design therefore in the first paragraph

Development of headings and subheadings of the article with subsequent numbers

On March 11, 2020 (approximately 4 years ago) the World Health Organization (WHO) declared COVID-19 as a pandemic, which had different symptoms in people like flu, headache, fever, provoking the use of mouth covers as well as disinfecting clothes, sanitizing places since then the disease has infected approximately 500 million people in almost 200 countries and has killed more than six million people worldwide, but has not yet ended now a new WHO notification on the term global health emergency by COVID-19, Mexico conducted a local assessment where there was reactivation of the same, on May 9, 2023, by publishing in the Official Journal of the Federation, the DECREE declaring ended the extraordinary action in the field of general health that aimed to prevent, control again,

It is a rectangular geared motor base with four wheels (rims) for its displacement.

Box 1

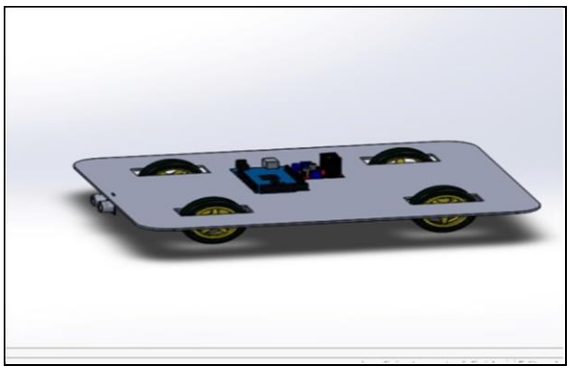

Figure 1
Wheel base

The part of the tower is a panel where there are 4 columns joining the base (bottom base image) with measures of 20cm wide, 15.2 m long and 1.20 m high, with 2 small square bases which we form with angles in the middle and at the top.

Box 2

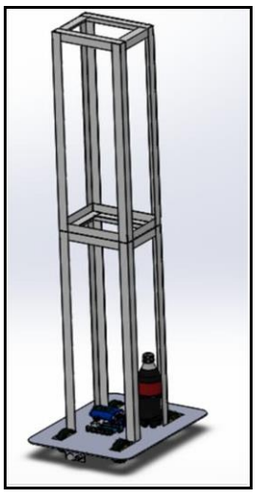

Figure 2
Tower base

Gun part

The upper part is a base where the displacement angle of the gun is marked, which will have two infrared sensors to detect the movement it is making. This operation is carried out by the servomotor that makes it rotate from one side to the other.

Box 3

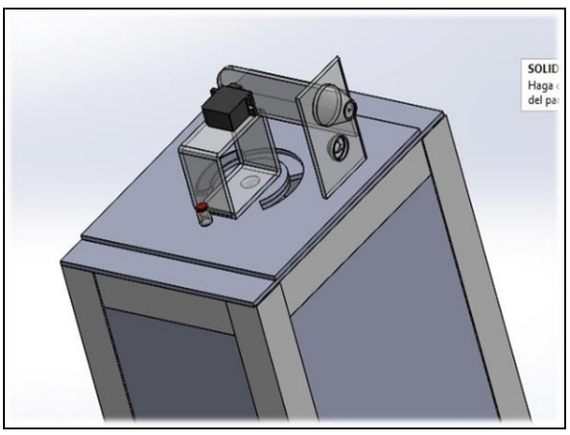

Figure 3
Top

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In the electrical design, it allows a simulation where the behaviour and operation of the electronic circuit such as the power supply and measuring instruments can be visualised in a quick and easy way, making a simple circuit analysis, but with parametric dependencies and non-linear elements.

Box 4

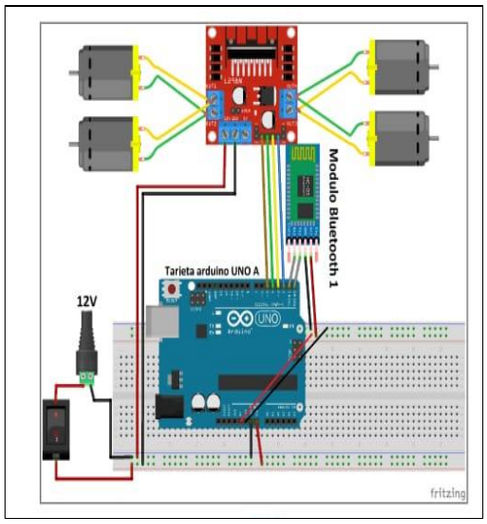

Figure 4
Connection

Methodology

CDIO

- Conceiving the product is a stage that includes the analysis of customer needs that define the product, taking into account technology, company strategy, and regulations; and the development of conceptual, technical and business plans.

- Design The second stage, design, focuses on the creation of the design, its detailed drawings, the algorithms describing the product, process or system to be implemented.

- Implement The implementation stage refers to the transformation of the design into a product, including hardware manufacturing, software coding, integration, testing and validation.

- Operate The last stage, operation, uses the implemented product, process or system to deliver the desired value, including maintenance, product evolution, recycling and retirement of the system.

Results

The sanitising robot moves easily from one side to another depending on the manipulation that is given with the application, being automatically stop when it finds objects that obstruct its passage, performing the sanitisation through the gun which gives 360 ° turns, keeping it in operation with a duration of 4 hours. continuous since it is when the energy provided by the batteries is finished.

Box 5

Figure 5
Operation

Conclusions

Due to the pandemic caused by COVID-19 that was experienced worldwide and the new outbreak that occurred in 2024, it is important to prevent the spread of the virus since the sanitary protocols are no longer applied, which is why the mechatronics engineering course designed a prototype of a classroom sanitising robot, considering the time of stay and cleaning there is no disinfection in this way the project is a sanitizing robot controlled by arduino through a mobile application to sanitize the classrooms of the building f helps to prevent the spread of viruses to make their journey and sanitize.

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Abbreviations

Automaton: apparatus that contains within itself the mechanisms necessary to execute certain movements or tasks similar to those carried out by man, manifesting itself as an animated being capable of imitating gestures.

Automation: This is the name given to any task carried out by machines instead of people. It is the replacement of manual procedures by computer systems.

Robot arm: One of the parts of the manipulator. Supported at the base of the manipulator, it holds and operates the wrist (where the gripping tool is installed).

Circuit: is a cycle, an uninterrupted path that allows, for example, current to flow out of one side of the battery and back in the other. A circuit is also needed to draw power from the socket.

Controller: the part of the software that controls a particular peripheral.

Digital: representation of information based on a discrete numerical code.

Device: mechanism of an apparatus or equipment that, once activated, automatically performs its assigned function.

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Abstract (In English, 150-200 words)

Objectives
Methodology
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Abstract (In Spanish, 150-200 words)

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

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* Correspondence to Author (example@example.org)
† Researcher contributing as first author.

Introduction

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

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

What is your added value with respect to other techniques?

Clearly focus each of its features

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

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

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

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

Including graphs, figures and tables-Editable

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

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

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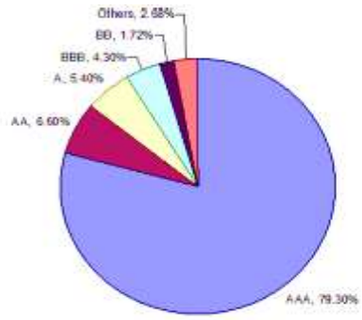

Figure 1 Title and Source (in italics).

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

For the use of equations, noted as follows:

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

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

Methodology

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

Results

The results shall be by section of the Article.

Annexes

Tables and adequate sources

Thanks

Indicate if they were financed by any institution, University or company.

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Conclusions

Explain clearly the results and possibilities of improvement.

References

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

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

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

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Keywords
Article sections, for example:

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2. Description of the method
3. Analysis from the regression demand curve
4. Results
5. Thanks
6. Conclusions
7. References

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