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Journal-Microeconomics

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Information and uncertainty, Criteria for Decision-Making under risk and uncertainty, Asymmetric and private information, Search, Learning, and Information, Expectations, Speculations; Intertemporal choice and growth: Intertemporal consumer choice, Life cycle models and saving, Intertemporal firm choice and growth, Investment, or Financing with diverse approaches and perspectives, That contribute to the diffusion of the development of Science Technology and Innovation that allow the arguments related to the decision making and influence in the formulation of international policies in the Field of Social Sciences. The editorial horizon of RINOE® extends beyond the academy and integrates other segments of research and analysis outside the scope, as long as they meet the requirements of rigorous argumentative and scientific, as well as addressing issues of general and current interest of the International Scientific Society.

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Social choice, Clubs, Committees, Economic models of political processes, Bureaucracy, Administrative processes in public organizations, Conflict, Conflict resolution, Alliances, Positive analysis of Policy-Making and implementation; Information and uncertainty, Criteria for Decision-Making under risk and uncertainty, Asymmetric and private information, Search, Learning, and Information, Expectations, Speculations; Intertemporal choice and growth: Intertemporal consumer choice, Life cycle models and saving, Intertemporal firm choice and growth, Investment, or Financing and other topics related to Social Sciences.

Presentation of Content

In the first article we present*, Design of a tool to integrate the costs of dental treatments. Case study: dental station clinic*, by Avila Morales, Fernando Javier Maximiliano, Guillermo-Chuc, Giselle, Quijano-García, Román and Patron-Cortes, Roger Manuel, with adscription in the Universidad Autónoma de Campeche, as the next article we present, *Innovation in student care: development of a comprehensive system for project management,* by Navarrete-Prieto, José Antonio, Díaz-Rincón, Hilda, Hernández-Castillo, Eric and Carrizales-Longoria, José David, with adscription in the Tecnológico Nacional de México - Instituto Tecnológico de Tlalnepantla, as the next article we present, *Proposal of a sustainability model for comprehensive medical centers in the south of the state of Tamaulipas*, by Pérez-Pérez, Iris Cristel, Aguirre-Arias, Miriam and González-Gamez, Liliana, with adscription in the Tecnológico Nacional de México campus Ciudad Madero and TecNM Instituto Tecnológico Superior de Pátzcuaro, as the next article we present, *Influence of training on productivity. A study in micro service companies*, by Sarmiento-Paredes, Susana, Carro-Suárez, Jorge, Nava, Doroteo and Larios-Gómez, Emigdio, with adscription in the Universidad Autónoma de Tlaxcala and Universidad Popular Autónoma del Estado de Puebla, as the next article we present, *Consumption of armed catfish (Hypostomus plecostamus) in the municipality of centro, Tabasco*, by Rivera-Rodríguez, Maria, Hernández-Martínez, María del Carmen, González-Izquierdo, Karina and Torres-Magaña, María Patricia, with adscription in the Tecnológico Nacional de México/Instituto Tecnológico de Villahermosa, as last article we present, *Productivity improvements and sustainable management in the cooperative fishing society barra ciega of centro municipality, Tabasco*, by Vidal-Reyes, Lauraa, Javier-Geronimo, Zinathb, Reyes-Osorio, Yaitla Aitzac and Rivera-Rodriguez, María, with adscription in the Instituto Tecnológico de Villahermosa.

Content

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Article

Design of a tool to integrate the costs of dental treatments. Case study: dental station clinic

Diseño de herramienta para integrar los costos de tratamientos dentales. Caso clínica dental station

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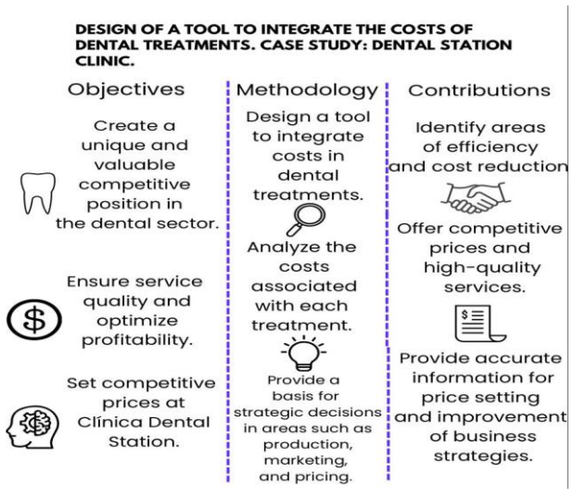
Abstract

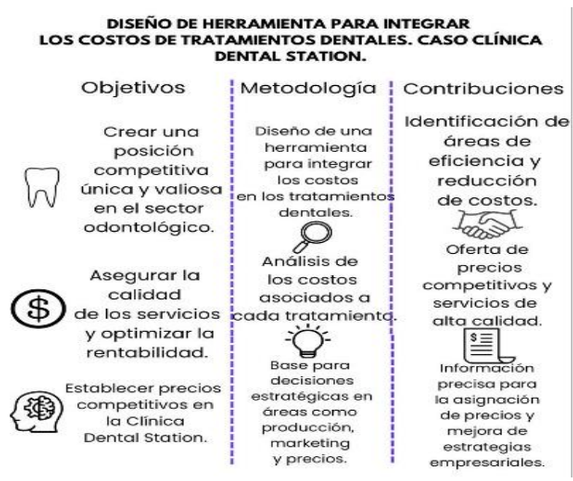
Every company must adopt a plan focused on creating a unique and valuable strategic position in the business realm. This competitive position should generate dissonance with other companies in the same sector. Dental services require strategies to ensure their quality and profitability. Cost integration is a key method to achieve both objectives. This research explores the potential of cost integration to achieve the pricing objective at Dental Station Clinic. An efficient methodology allows for informed decisions about pricing, production, marketing, and other areas, contributing to improved profitability by identifying areas of efficiency and cost reduction. Furthermore, it strengthens competitiveness in the market by enabling the offering of competitive prices and high-quality products or services. The study uses a descriptive methodology to design the tool that will integrate costs for dental treatments, which will enhance profitability. The results obtained will help identify incurred costs and assign selling prices to dental treatments.



Cost integration, Competitiveness, Profitability

Resumen

Toda empresa debe adoptar un plan centrado en la creación de una posición estratégica singular y valiosa en el ámbito empresarial. Esta posición competitiva debe generar disonancia con otras empresas del mismo sector. Los servicios odontológicos requieren de estrategias para garantizar su calidad y rentabilidad. La integración de costos es un método clave para lograr ambos objetivos. Esta investigación explora el potencial de la integración de costos para lograr el objetivo de fijar precios en la Clínica Dental Station. Una metodología eficiente permite tomar decisiones informadas sobre precios, producción, marketing y otras áreas, contribuyendo a la mejora de la rentabilidad al identificar áreas de eficiencia y reducción de costos. Asimismo, fortalece la competitividad en el mercado al posibilitar la oferta de precios competitivos y productos o servicios de alta calidad. El estudio utiliza una metodología descriptiva para diseñar la herramienta que permita integrar los costos para los tratamientos dentales que mejorarán la rentabilidad. Los resultados obtenidos permitirán identificar.



Integración de costos, Competitividad, Rentabilidad

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Introduction

Cost integration as a pricing strategy represents an innovative perspective that directly impacts the competitiveness of dental practices. By understanding and effectively managing the outlays associated with treatments, practitioners have the ability to adjust their pricing strategies precisely and in line with market expectations. The proposed study not only seeks to enhance competitiveness, but also to optimise the profitability of dental practices. Identifying specific cost areas and assessing their integration into the pricing structure opens up the possibility of maximising profit margins without compromising the quality of services offered. This approach translates into sound and sustainable financial management for dental professionals.

In addition, the focus on competitiveness and profitability could have a positive impact on the accessibility of dental treatment to a wider public. Efficient cost management enables clinics to offer competitive fees without sacrificing quality of service, generating benefits for both practitioners and patients.

According to Fernandez (2018), healthcare specialists must become managers in order to succeed. This means changing their traditional vision, which focuses on providing high-quality medical care, to an entrepreneurial vision focused on selling their services, organising and coordinating their staff, and generating profits.

Problem statement

In the dental service delivery sector, the pricing system is based on competition (Brull, 2014), without an analysis of the production and operational costs incurred by the organisation in developing its processes. This praxis has prevailed even before social networks, where competition focused on additional factors such as the prestige of the health professional. The current pricing strategy at Dental Station is affected by the lack of a cost study and competitive pressure that has led to the distortion of the perception of the real costs of dental treatment.

The repercussions for the company include decreasing profitability, liquidity, quality of services and creating an environment that discourages healthy competition. The lack of a proper pricing method has significant consequences for the organisation, including the loss of customers, the quality of services, and the damage to its image as a dental institution. In addition, the organisation faces constraints caused by the recent reopening of the facility, lack of experience in resource management and restricted cash flows.

Taking into consideration the above, the following general objective is presented: To design the tool for the integration of costs as a pricing strategy in dental treatments in order to enhance competitiveness and profitability. And as specific objectives:

a) To describe the existing cost theories.

b) To recognise the tools for cost integration.

c) To distinguish the factors that influence sectorially the pricing of dental treatments.

d) To identify the success cases.

e) To design the tool for cost integration as a measure of profitability.

Theoretical framework

According to Scoponi et al. (2018), the General Cost Theory (GCT) comprises the composition, variability and accumulation of costs as well as factor categories. Market segmentation establishes the target group of people with similar characteristics to which a service or product is addressed (Cárdenas et al., 2020). In addition to the above, this makes it possible to draw up marketing strategies that are aimed at increasing customer traffic. It serves as a guide in strategic decision making, allowing to delimit the guidelines of this chapter, in order to conceptualise different terms that underpin the proposed solution in this research.

Cost theory for pricing

GCT is examined through two perspectives, the prescriptive one that focuses on the objective meaning of a protocol and the descriptive one through the circumscription of how it perceives information (Scoponi et al., 2018).

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According to Gonzaga (2018), TGC indicates the methodology when defining costs in an analysable scenario as opposed to an ideal situation. The path that allows pricing must have a deep analysis of the cost, it is presented as an indicator of economic efficiency in function of allowing the comparative between results in different time lapses (Gómez et al., 2018).

According to Tiepermann and Porporato (2021), costs are defined as the resignation of resources allocated to meet a particular objective and are classified according to their function, allocation (direct and indirect), behaviour and variability (Castillo et al., 2019). With the vast observation, knowledge of the costing unit is obtained, which can be subjected to measurement in order to attribute and allocate costs (Scoponi et al., 2018). According to Cordoba and Moreno (2017), cost-based pricing can lead to underestimating the attractiveness of the product or service, which can result in the market rate being lower than its true value.

Cost elements are the division of disbursements made in production processes and are accumulated in the inventory category of developing items (Rincón et. al., 2019). As Gómez et al. (2018), expenditure is understood as the measure of consumption linked to the capacity granted to carry out processes. According to Gómez et al. (2018), it is conceptually posed as a cost that has generated benefits and has expired, i.e. it has borne fruit; in this way, it makes it possible to obtain income, in other words, benefits.

Costs can be divided into two according to their evaluation time, real historical costs that examine the disbursements incurred in the past and interpret them in order to evaluate the management carried out in the development of the activity. They can also be budgeted, these collect information from the past and present and attempt to describe what management will look like, deciphering and revealing possible future outcomes (Molina et al., 2019). In allocation, direct costs are clearly recognised in a cost object through an obvious quantitative tracking mechanism, while indirect costs can only be described in that element through a specific attribution formula (Toro, 2016).

The unit of costing is constant, what varies are the ways of representing it; the categories are not similar because the classification attributes defining the division rules are different (Scoponi et al., 2018). The elements of cost are identified based on the group that grants to capture the disbursement applied by the company in the production phase of its products or services (Rincón and Sánchez, 2019). There are other ordinary manufacturing outlays that do not fall between material and indirect labour.

There are two classifications of costs that coincide in the elements they describe, the first is by volume (Molina et al., 2019) and the second is by behaviour (Cárdenas et al., 2020), both mentioning both variable and fixed costs. The latter remain unchanged in isolation from variation in production. They are subject to changes by management, therefore, they are not affected by fluctuations in activities. Step costs are referred to by their unchanging behaviour during certain production lapses (Parra et al., 2014).

These outlays are subject to changes in a firm's activities and vary in line with production volumes (Gómez et al., 2018). Semi-variable costs constitute a sub-category that is characterised by having both a static and a variable part (Parra et al., 2014).

Identification of factors influencing the pricing of dental treatment

Fee setting in dental services is a complex process that involves taking into account various factors, both internal and external, which play a crucial role in identifying and determining the appropriate cost for dental treatments (Fernandez, 2018). The key aspects of each category are detailed below:

Internal Factors:

- Costs: It is essential to consider the cost of production when setting prices, encompassing expenses associated with raw material (M.P.D.), labour (direct and indirect) and general practice outlays (C.I.F). An accurate understanding of this data is essential to determine the appropriate costing method to cover operating expenses and ensure financial viability.

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- Profitability: The company must ensure that the values set allow for adequate profitability. This involves establishing the break-even point to support the long-term sustainability of the clinic.

- Marketing Objectives: The main goal will be to generate customer experiences through social networking, innovative treatments through the use of new biomaterials, technological tools and techniques (Tiol, 2019).

External Factors:

- Competition: The organisation must be aware of market rates to adjust its amounts in a competitive and attractive way for patients (Rodriguez, 2015).

- Demand: Demand is influenced by various factors, such as the perceived need for care, the selling price and the customer's perception of value. Understanding these aspects helps to establish values aligned with market expectations (Gonzaga et al., 2018).

- Regulations: Government regulations can directly affect the price of dental treatments such as the payment of Income Tax (ISR) for business activities, the organisation's registration of its workers with the Mexican Social Security Institute (IMSS). It is essential to comply with established regulations and adjust fees according to legal restrictions and requirements (Tiol, 2019).

Market segmentation is a process by which patients receive appropriate treatment for their health problems and clinics dispose of their resources to solve and monetise that need (Paredes, 2014).

According to Paredes, (2014), a niche is a group of consumers that is even narrower than a segment and whose demands are unsatisfied. The B2C (Business to consumer) approach aims at the consumption of the service by the customer. Its segmentation criteria include geographic, psychographic, behavioural and demographic.

For the dental company, the last group will be addressed because it is divided into age, gender, family size, family life cycle, generation, income, occupation, education, religion, race and nationality (Ciribeli and Miquelito, 2015).

This division is made in order to align demographic characteristics with the dental mix, headed in breadth by specialties such as Orthodontics, Oral Rehabilitation, Surgery and Paediatric Dentistry, and in depth by the service offerings of each. The alignment of the specialities with the postgraduate programmes allows for efficient market segmentation, for example:

The primary target market of paediatric dentistry, would be children and adolescents between one month to 12 years as users and their parents or guardians as buyers, their niche would be patients with some disabling congenital and genetic variation, such as a 23 year old adult with cerebral palsy (Medina et al., 2020).

Every company must adopt a plan focused on creating a unique and valuable strategic position in the business environment. This competitive position must create dissonance with other companies in the same sector. Companies have three options to achieve a more favourable position against the competition, according to Chirinos and Rosado, (2016):

- We can find the generic cost strategy in the first place, which has been implemented in most national companies in order to optimise processes and generate economies of scale that make it possible to offer products at lower prices, in the case of the dental clinic would be to establish a cost system that manages to identify, group and efficiently determine the different disbursements disbursed for the setting of sales prices for each service offered.

- Secondly, there is the basic tactic of targeting, applied exclusively to a niche market, adapting to the specific needs of that customer group, distinguishing the mix of services in breadth (specialities) and depth (treatments by speciality) in order to offer each one according to the particular requirements of the applicants.

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- The third approach, less commonly used, but still an opportunity, is the overall differentiation plan, characterised by offering products with superior value in terms of design, functionality and service. If this leads to superior performance, the company is said to have developed a competitive advantage.

Competitiveness and Profitability

According to Herrera et al. (2016), competitiveness is a dynamic factor, as higher profitability enables faster accumulation and lower costs through economies of scale. This can translate into increasing market share, which eventually leads to the disappearance of firms that are less competitive and unable to generate sufficient returns.

Profitability is the measure of the return on capital employed in a given period (Ochoa and Marrufo, 2020). Financial ratios are analytical tools to assess the performance and financial health of a company. These indicators provide valuable information for decision-making and analysis of operational efficiency (Sarango et al., 2023).

The evaluation of the profitability of dental procedures is a crucial factor for strategic decision-making in clinics and practices. The performance of different profitability indices allows to analyse the financial viability of treatments, to optimise the management of resources and to determine the convenience of offering certain services.

Methodology

Dental health care companies in Mexico are deficient in their financial planning, as they lack efficient strategies for the application of costing systems. This aspect is directly reflected in pricing, as internal and external factors that affect sales values and, therefore, the organisation's profits are not taken into consideration.

This research used the case method developed to illustrate situations, actions or decisions as a story of events that have occurred and from which lessons can be learned, with the objective of providing real means that allow, through analysis and discussion, to present alternative solutions that have been applied in similar situations and that were developed based on the main concepts and theories associated with the phenomenon under study (Naumes and Naumes, 2006).

The case method seeks not only to identify the factors that affect a phenomenon, but also the detailed knowledge of these factors in the units of analysis (Marcelino, Baldazo and Valdés, 2012).

The methodological design used is nested of an illustrative type, as it presents or exemplifies the phenomenon that is investigated under a specific theory approach consisting of a single case with more than one unit of analysis: the different cost components of Dental Station are analysed, in order to develop a tool in a spreadsheet programme that can integrate all the disbursements incurred in order to be able to assign sales prices to the different dental treatments in order to increase competitiveness and profitability (Yopan, 2020).

This proposed costing tool can be applied to make comparisons over different time periods to see if it does indeed work as a measure of profitability, as well as to enable the use of various marketing strategies to attract and retain customers. The services presented were two of the most representative services, consultation and resin, in order to exemplify the integration of costs. The tool was designed using Microsoft Excel with the intention of facilitating its application for dental service companies.

The project phases are arranged in a logical sequence based on the theoretical construction of the previous chapter. Through two general schemes, the first stage identifies and describes the fixed and variable costs (Figure 1), while the next stage determines the direct raw material per service (Figure 2) in order to be added to the formula for the calculation of the sales price..

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Box 1

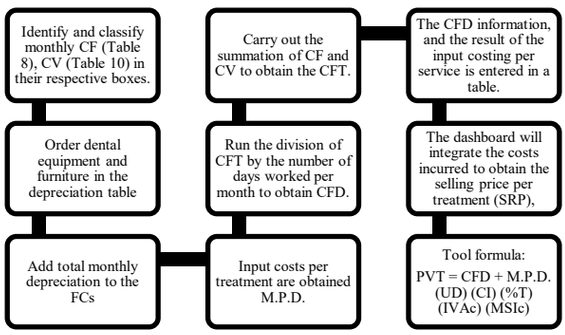

Figure 1

Methodology for the integration of costs

Source: own elaboration with data from Ávila et al. (2023)

Box 2

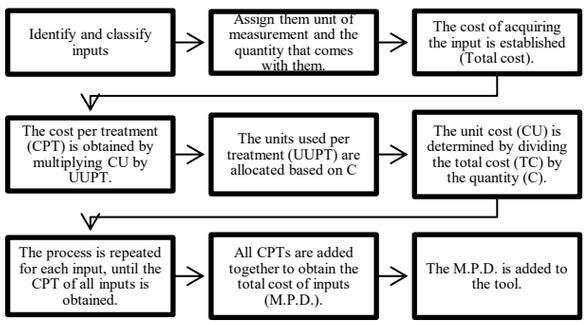

Figure 2

Procedure for the costing of inputs per treatment

Source: own elaboration with data from Ávila et al. (2023)

Results

Organisational background

In 1988, Dr. Román Avila Parrao founded the Oral and Maxillofacial Surgery Dental Clinic to address the shortage of specialists in this field in the state of Campeche. Although there was a high demand for Maxillofacial Surgery services, the population was unaware of the speciality, so they turned to general dentists. However, due to the complexity of the conditions, they could not solve all the problems, so some referred patients to Dr. Avila's office, which allowed him to build up a portfolio of clients. With the constant changes in dentistry, the increase in preventive oral health care and competition from other specialists, the practice began to lose surgery patients. Initially, the practice was staffed by Dr. Avila and an assistant.

In May 2023, the clinic acquired a new identity, Station Dental Clinic, to reflect its new focus on comprehensive oral health care. They added Dental Surgeon Eduardo Avila Morales, specialist in Orthodontics; C.D. Paulina Arce Hadar, in charge of Oral Rehabilitation; Fernando Avila Morales, dentist and general manager; administrative assistant; dental assistant; and a cleaning assistant. The clinic has had three different locations throughout its history. The first, on Calle 16 in the San Roman neighbourhood, was chosen because of its proximity to busy areas. In 2002, the clinic moved to Calle 12 in the Samulá neighbourhood, because the property at the first location was under lease and not large enough.

The last change was to Calle Prolongación Allende, in 2022, to provide ample space, ease of access and parking opportunities. The clinic, founded in 1988, focused on oral and maxillofacial surgery until 2020.

However, the COVID-19 pandemic forced the organisation to suspend operations. In mid-2021, consultation is resumed for a limited number of patients. However, the client portfolio decreased considerably due to various factors such as the cessation of activities during the contingency, lack of marketing strategies and a very limited supply of treatments in the different specialties. Subsequently, in 2022, the new work team was reorganised and the clinic was in the process of changing its location.

In 2023, it redefined its concept, going on to offer a comprehensive range of dental services. This in order to generate a new patient base and achieve patient loyalty.

Design of the tool the analysis of the clinic's costs begins with their classification. Fixed costs are made up of outlays that do not change over a period of time. Among them we can find the remuneration of dental staff, which for working purposes is classified as MOD, while payments related to staff in other areas are categorised as MOI. Also grouped under C.I.F. are expenditures to cover items indispensable for the operation of the company such as rent and various services (Table 1).

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Box 3

Table 1
Fixed costs for the dental clinic

Fixed costs	Mensual
Rent	CF1
Doctor 1	CF2
Depreciation	AM
TOTAL, CF	CF = CF1+CF2+AM

Source: own elaboration with data from Avila et al. (2023) and Molina et al., (2019)

Among the depreciations (Table 2) we can find the dental unit, low and high speed parts, among others.

Box 4

Table 2
Depreciation

Depreciation of medical equipment and real estate			Depreciation rate (%PD)		
Product	Cost (C)	Useful life (years) (VU)	Residual value (VR)	Annual depreciation (AA)	Mensual (AM)
Dental Unit	C	VU	VR= C/%PD	AA1= (C-VU) / VR	AM1= AA/12
High and low part	C	VU	VR= C/%PD	AA2= (C-VU) / VR	AM2= AA/12
	CT			AA= AA1+AA2	AM= AM1+AM2

Source: own elaboration with data from Avila et al.. (2023).

The next step is to determine the variable costs (Table 3), different manufacturing overheads can be seen in services such as internet, electricity, among others.

Box 5

Table 3
Indirect variable costs

Indirect variable costs	Mensual
Internet	CV1
Electricity	CV2
TOTAL CV	CV= CV1+CV2

Source: own elaboration with data from Ávila et al. (2023)

Fixed cost per patient

The sum of fixed and variable costs allows us to calculate the total fixed cost (TFC). Next, we determine the number of working days per month, which will cover Monday to Saturday, totalling 24 days. We then divide the CFT by 24, which gives us the daily fixed cost (DFC). Finally, we estimate the number of patients to be seen per day, setting a value of 12, which will serve as the divisor for the CFD, resulting in the fixed cost per patient (CFP). The formula could be viewed as follows. CF + CV = CFT 2. CFT / 24 = CFD 3. CFD / 12 = CFP Table 4 shows the result of this formula applied to a dental company.

Box 6

Table 4
Obtaining the fixed cost per patient.

Cost per treatment at my Dental Clinic	Fixed costs	Indirect variable costs	Costo Fijo Total
TOTAL	CF +	CV =	CFT
Working days per month	24	M to S is 24 working days per month.	
Daily fixed cost	CFD = CFT /24		
Patients per day	12		
Fixed daily cost per patient	CFP = CFD/12		

Source: own elaboration with data from Avila et al.. (2023)

Costing of direct raw materials by treatment

The costs incurred in inputs per service will be obtained (Table 5). For this purpose, two treatments will be used as an example, general consultation and resin in anterior dental organs.

Box 7

Table 5
Inputs needed for general consultation

Consulta general	Nombre de producto	Unidad de medida	Cantidad (C)	Costo Unitario (CU)	Costo Total (CT)	Unidades utilizadas por tratamiento (UUPT)	Costo por tratamiento (CPT)
Insumo 1	Guantes	caja	C	CU= CT/C	CT	UUPT	CPT1 = CU * UUPT
Insumo 2	Cubrebocas	caja	C	CU= CT/C	CT	UUPT	CPT2 = CU * UUPT
						Total:	MPD = CPT1 + CP2

Source: own elaboration with data from Avila et al. (2023)

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The methodology used for the elaboration of the above tables was inspired by the information presented in the tables of Direct Raw Materials in the article "Industrial production costs in Ecuador" (Arias et al., 2020). Determination of the selling price based on the integration of costs. The sales prices will be determined by service (Table 6), the ones that will be presented are those of the general consultation and the resin in anterior dental organs. To do this, we will have to add up the M.P.D and PIC, and obtain the cost of the treatment without profit, then we will assign a desired profit percentage, multiply the cost without profit with the desired percentage, and this will result in the cost of the service with profit. Then multiply the above amount with the tax percentage. Finally, the calculations are made to be able to offer digital payments and interest-free months, the percentages will be obtained depending on the banking company that provides the services.

Box 8

Table 6

Integration of costs to determine the selling price

	%		%		%			%		%	
						12 patients per day			Months Free (MSI)		Interest Proposal
Service	MPD	CFP	CSUD	UD	CCU	CI	%T	IVAc	MSIc		PVT
Treatment	MPD	+ CFP=	CSUD	*UD	= CCU	CCU	* CI	*%T	*IVAc	*MSlc =		PVT

Note: Table showing the sum of costs to obtain the final selling price. Adapted from: own elaboration with data from Ávila et al.. (2023)

Desired profit and tax percentages may vary depending on the financial, fiscal and marketing strategies of the clinic that chooses to use the methodology. Selling prices may change according to the needs and objectives of each organisation.

Conclusions

The tool described above will allow the identification of costs incurred and the allocation of selling prices for dental treatment. The construction of the tool was based on the theoretical framework with the following points.

- The general cost theory and its components such as function, allocation and variability were described.
- The different costing systems such as absorption, direct, ABC, process and order costing were discussed.
- Elements such as market segmentation, differentiation and customer perceived valuation were presented.
- The different pricing strategies such as profitability margin, target price, demand and competition were also explained.
- The success stories presented showed how the costing systems were applied to two service companies.

The instrument was created in Microsoft Excel, based on the above information and data from the Dental Station clinic, and is an absorbing costing method since it groups fixed and variable costs.

The application of the previously designed costing methodology will influence:

- Efficient cost and inventory control.
- Distinction of incurred disbursements.
- Allocation of prices based on the cost integration performed and marketing strategies.
- Increased profitability as a result of the breakdown of costs and the addition of the desired profit margin.
- Patient satisfaction as a result of knowing that the sales prices of the services include interest-free monthly payments.

Detecting opportunities for improvement in financial planning.

The use of the tool in other clinics, in order to provide feedback on the work carried out and help them achieve their goals.

After the implementation of the tool at Dental Station, the following is suggested:

Establish a continuous monitoring of the tool in order to continuously improve it since costs at given times will be changing.

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Adopt a system for inventory control in order to optimise direct raw material costs and avoid losses in this area.

Adopt different marketing strategies in order to increase the client portfolio, among these measures can be addressed different treatment packages with reduced sales prices, maintain the offer of payment at months without interest, increase the value of the brand and attention by providing amenities such as air-conditioned areas, internet, pleasant waiting room with comfortable seating, among other proposals.

Measure and record the profitability of the organisation through the financial ratios described in the third chapter by means of a research work, since there is no information on these topics.

After testing the efficiency of the product, provide advice to other organisations in the sector that require it, such as private clinics and dental schools.

Explore the possibility of applying the methodology to speciality dental services such as Orthodontics, Surgery, Paediatric Dentistry and Endodontics.

Declarations

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 reported article.

Authors' contribution

Fernando Avila provided the framework, tool design and conclusions.

Giselle Guillermo formulated the introduction, its elements and methodology.

Román Quijano carried out the analysis of results.

Roger Patrón constructed the theoretical framework.

Availability of data and materials

The data used in the research is available for publication without access restrictions.

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Abbreviations

%PD: Percentage of depreciation.

%T: Amount charged by the terminal company per transaction.

AA: Annual depreciation.

ABC Costing: Activity Based Costing.

AM: Monthly amortisation.

C.I.F: Indirect manufacturing costs.

C: Cost.

CCU: Cost with profit.

CF: Fixed cost.

CFD: Fixed daily cost.

FPC: Fixed cost per patient.

CFT: Total fixed costs.

CI: Cost of taxes.

CPT: Cost per treatment.

CSUD: Cost without profit.

TC: Total cost.

CU: Unit cost.

CV: Variable cost.

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DA: Annual depreciation.

B2C (Business to consumer) approach: Aims at the consumption of the service by the customer.

IMSS: Mexican Social Security Institute.

INFONAVIT: Instituto del Fondo Nacional de la Vivienda para los Trabajadores (National Workers' Housing Fund Institute).

ISR: Income tax.

M.O.D: Direct labour.

M.O.I: Indirect labour.

D.P.M: Direct raw material.

MCU: Unit contribution margin.

VATc: Value added tax on transaction fee.

MSIc: Interest-free month commission.

EP: Break-even point.

PVT: Selling price.

Q. Sales volume of the product.

Qe: Sales volume of the product when profit is zero.

TGC: General Cost Theory.

UD: Desired Utility Percentage.

Ut: Utility.

UUPT: Units used per treatment.

V: Sales.

RV: Residual value.

VU: Useful life.

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Article

Innovation in student care: development of a comprehensive system for project management

Innovación en la atención estudiantil: desarrollo de un sistema integral para la gestión de proyectos

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Abstract

In today's learning environment, implementation and innovation in information systems is essential for the efficient functioning of educational organisations. This applied research focuses on the automation of degree project management, with a focus on improving communication between students and teachers. SAGEP seeks to provide an automated solution that facilitates interaction and continuous monitoring, thus optimising the identification and resolution of academic or administrative problems in a timely manner. The key innovation lies in automated appointment control and student progress monitoring, which promotes more effective collaboration. Using a mixed methodology, with qualitative surveys and quantitative analysis, improvements in operational efficiency and educational quality will be evaluated, fostering an academic environment aligned to new technologies and promoting continuous process improvement.

Objectives	Methodology	Contributions
Provide an automated solution that facilitates interaction and continuous monitoring, thus optimizing the identification and resolution of academic or administrative problems in a timely manner.	Software is developed under the approach of applied technological research, since no two software development projects are the same, since each one has very different priorities, requirements, and technologies, [3] indicates that the objective of technological research is to obtain the desired product with the required quality and cost through technological integration. A mixed methodology is used, with qualitative surveys and quantitative analyses	Achieve automation of degree project management, with a focus on improving student-faculty communication including automated appointment control and monitoring of student progress, which promotes more effective collaboration.

Innovation, Quality, Project Management, Degree

Resumen

En el entorno de aprendizaje actual, la implementación e innovación en sistemas informáticos es esencial para el funcionamiento eficiente de las organizaciones educativas. Esta investigación aplicada se enfoca en la automatización de la gestión de proyectos de titulación, con un enfoque en la mejora de la comunicación entre estudiantes y docentes. SAGEP busca proporcionar una solución automatizada que facilite la interacción y el seguimiento continuo, optimizando así la identificación y resolución de problemas académicos o administrativos de manera oportuna. La innovación clave radica en el control automatizado de citas y el monitoreo del progreso del estudiante, lo que promueve una colaboración más efectiva. Utilizando una metodología mixta, con encuestas cualitativas y análisis cuantitativos, se evaluarán las mejoras en la eficiencia operativa y en la calidad educativa, impulsando un entorno académico alineado a las nuevas tecnologías y fomentando una mejora continua en los procesos.

Objetivos	Metodología	Contribuciones
Proporcionar una solución automatizada que facilite la interacción y el seguimiento continuo, optimizando así la identificación y resolución de problemas académicos o administrativos de manera oportuna.	El software es desarrollado bajo el enfoque de **investigación aplicada tecnológica**, ya que no existen dos proyectos de desarrollo de software que sean iguales, ya que cada uno tiene prioridades, requerimientos, y tecnologías muy diferentes, [3] indica que el objetivo de la investigación tecnológica es obtener el producto deseado con la calidad y el costo requeridos a través de la integración tecnológica. Se utiliza una metodología mixta, con encuestas cualitativas y análisis cuantitativos	Lograr una automatización de la gestión de proyectos de titulación, con un enfoque en la mejora de la comunicación entre estudiantes y docentes incluyendo el control automatizado de citas y el monitoreo del progreso del estudiante, lo que promueve una colaboración más efectiva.

Innovación, Calidad, Gestión de Proyectos, Titulación

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Introduction

In today's educational environment, characterised by an increasing reliance on technology and information, process automation has become a critical factor for the efficiency and effectiveness of academic institutions. Degree project management, which involves coordination between students and faculty, is one area that can benefit significantly from technological innovation. Traditional management systems often face challenges related to lack of adequate follow-up, communication problems and delays in resolving academic or administrative issues.

SAGEP (Automated Degree Project Management System) presents itself as a comprehensive solution to address these challenges, providing a platform that facilitates the organisation, appointment control and tracking of student progress. This applied research focuses on the implementation of SAGEP to optimise open and effective communication between stakeholders, ensuring a more coherent educational experience aligned with the demands of the contemporary academic and professional environment. The introduction of automated technologies not only improves the quality of education, but also drives a culture of continuous improvement and adaptability in higher education institutions.

State of the Art

The automation of project management through web-based systems has become an essential strategy to improve efficiency and effectiveness in educational environments. These systems allow for optimised resource allocation, improved communication and more accurate tracking of student progress. In modern academic environments, the ability to manage projects in real time and access information remotely is critical for flexibility and educational continuity (Lagstedt et al., 2020; Armenia et al., 2019).

Automated web-based systems offer multiple benefits for degree project management. They facilitate the planning, scheduling of assignments, monitoring and evaluation of projects, which is critical for maintaining quality and efficiency in academic processes.

Operating through web-based platforms, these systems allow continuous access from any location with an internet connection, thus enhancing collaboration between students and faculty (Hansson, 2014). Automation reduces human error and provides transparency, resulting in more reliable and accurate management of degree projects (Fitzgerald et al., 2014).

In higher education institutions, the implementation of automated web-based systems has shown significant improvements in operational efficiency and quality of education. Systems that include features such as automatic appointment scheduling and continuous tracking of student progress have optimised coordination between students and faculty, fostering effective and timely communication (Armenia et al., 2019). In addition, the ability to collect and analyse data in real time facilitates more informed decision-making and better management of educational resources (Lagstedt et al., 2020).

Similarly, Stockholm University in Sweden uses SciPro, an automated system to support thesis writing, which facilitates communication between students and supervisors, manages progress monitoring and automates the scheduling of meetings and reviews (Hansson, 2014). At the MIT Sloan School of Management in the US, digital tools have been adopted for educational management, enhancing informed decision-making and real-time task management (Fitzgerald et al., 2014). Similarly, the University of Surrey in the UK and the Technical University of Munich (TUM) in Germany have implemented automated tools for academic and research project management, improving collaboration and operational efficiency in their educational programmes (Lagstedt et al., 2020; Armenia et al., 2019).

Despite the benefits, the adoption of automated web systems in education presents challenges. Some critics argue that an over-reliance on automation can lead to a reduction in social interaction, which is fundamental in traditional education (Horning, 2021). In addition, data security and privacy are critical concerns, as these systems collect and process large volumes of personal information (Andrejevic, 2020).

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Implementing automated systems not only improves operational efficiency, but also allows teachers to focus on more valuable pedagogical activities. Automation frees up time by handling routine administrative tasks, allowing teachers to devote more effort to tutoring and direct academic support (Fitzgerald et al., 2014). This ability to integrate technologies into accessible platforms fosters effective collaboration between students and faculty, which is essential for successful degree projects.

Automating project management through web-based systems has become an essential strategy for improving efficiency and effectiveness in educational environments. These systems allow for optimised resource allocation, improved communication and more accurate tracking of student progress. In modern academic environments, the ability to manage projects in real time and access information remotely is critical for flexibility and educational continuity (Lagstedt et al., 2020; Armenia et al., 2019).

Automated web-based systems offer multiple benefits for degree project management. They facilitate the planning, scheduling of assignments, monitoring and evaluation of projects, which is critical for maintaining quality and efficiency in academic processes. Operating through web-based platforms, these systems allow continuous access from any location with an internet connection, thus enhancing collaboration between students and faculty (Hansson, 2014). Automation reduces human error and provides transparency, resulting in more reliable and accurate management of degree projects (Fitzgerald et al., 2014).

In several higher education institutions, the implementation of automated web-based systems has shown significant improvements in operational efficiency and quality of education. For example, the Universidad Técnica del Norte (UTN) in Ecuador has implemented an automated system for the management of research groups and networks, facilitating more effective control of project progress and coordination between different actors (Repositorio Digital Universidad Técnica del Norte, 2024).

Similarly, Stockholm University in Sweden uses SciPro, an automated system to support thesis writing, which facilitates communication between students and supervisors, manages progress monitoring and automates the scheduling of meetings and reviews (Hansson, 2014). At the MIT Sloan School of Management in the US, digital tools have been adopted for educational management, enhancing informed decision-making and real-time task management (Fitzgerald et al., 2014). Similarly, the University of Surrey in the UK and the Technical University of Munich (TUM) in Germany have implemented automated tools for academic and research project management, improving collaboration and operational efficiency in their educational programmes (Lagstedt et al., 2020; Armenia et al., 2019).

Despite the benefits, the adoption of automated web systems in education presents challenges. Some critics argue that an over-reliance on automation can lead to a reduction in social interaction, which is fundamental in traditional education (Horning, 2021). In addition, data security and privacy are critical concerns, as these systems collect and process large volumes of personal information (Andrejevic, 2020).

Implementing automated systems not only improves operational efficiency, but also allows educators to focus on more valuable pedagogical activities. Automation frees up time by handling routine administrative tasks, allowing teachers to devote more effort to tutoring and direct academic support (Fitzgerald et al., 2014). This ability to integrate technologies into accessible platforms fosters effective collaboration between students and faculty, which is essential for successful degree projects.

The automation of degree project management through web-based systems offers significant opportunities to improve the efficiency and quality of education. However, it is critical to implement these technologies in a balanced way, ensuring that the human elements of teaching are maintained and privacy and security concerns are addressed.

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Methodology

The methodology used in this research combined qualitative and quantitative approaches, following an applied and mixed research design. This methodology allowed for the evaluation of the implementation of an automated degree project management system, providing a comprehensive understanding of its impact on the efficiency and quality of education.

The applied approach focused on solving specific problems related to degree project management through the development of an automated system. According to Creswell (2014), applied research aims to use the results to solve practical problems and improve professional practice. This type of approach is ideal for studies that seek to apply findings directly in real-world contexts, such as in educational institutions, where efficient project management is crucial for academic success.

The research combined qualitative and quantitative methods to provide a comprehensive evaluation of the automated system. According to Tashakkori and Teddlie (2003), mixed methodology allows for a better understanding of research problems by using multiple forms of data collection. This approach was key to assessing both qualitative perceptions and quantitative outcomes associated with the implementation of the system.

Semi-structured interviews and focus groups were conducted with teachers, academic leaders and students, following Merriam's (2009) recommendations on the importance of using qualitative methods to understand participants' experiences and perceptions. In this study, a total of 45 students from the Information and Communication Technologies (ICT) Engineering course taking the Research Workshop II subject, 3 lecturers who teach the subject and the Head of Linking Projects who are the main actors influencing the administration and process of the Integrated Degree were interviewed. The focus groups provided a space for in-depth discussion of experiences with current systems and expectations of the automated system.

Fowler (2009) highlights the importance of surveys in gathering statistical data, which allow for measuring the impact of the system and making objective comparisons before and after its implementation. The applied and mixed research methodology provides a solid framework for evaluating the effectiveness of an automated degree project management system. By combining qualitative and quantitative methods, this methodology provides a comprehensive understanding of how these technologies can improve project management in the educational environment by optimising communication and task tracking.

Problem statement

During the course of the integration process, significant difficulties were detected that persistently affect those involved, starting with the fact that there is no mention of defined deadlines in some processes and even some exist but are not met, as in the case of students sending their pre-project to those in charge of project management, a situation that causes delays when assigning an advisor to projects, which in turn generates rushed advising and therefore causes delays in the development of projects, In some cases, the advisor is not known physically and therefore there is no way of contacting him or her. If the aforementioned problems continue, they may generate more problems caused by the current problems, leading to confusion, delays in processes, urgent workloads, inconsistencies, unassertive decisions and unnecessary postponements.

The formats that are developed by the department or the advisor during this process are elaborated manually, generating implicit delays because they are developed by the staff, without omitting that at a certain point their elaboration may contain errors that cause them to be redone. In general terms, specific metrics, necessary for decision making and essential for future project planning, are not performed for this process.

Therefore, the creation of a web application that integrates various modules where, in a complete way, the information of the projects will allow their assigned advisor to generate their respective appointments for advice, so that the establishment of a more effective and dynamic form of communication.

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For the development of the system, the Unified Process Development (UPD) was used. UPD is an iterative, model-driven software development methodology that focuses on defining the processes and phases required to build a robust system. This methodology is ideal for web projects and is widely used in both academic and industrial development environments.

The Unified Development Process is an iterative methodology that follows four main phases for software development:

Initiation: This phase focuses on defining the scope and vision of the project. Essential requirements are established and a basic model of the system is built. The main objective is to understand what is to be built and why. In this phase, the key stakeholders and use cases that the system will support are also identified (Jacobson, Booch, & Rumbaugh, 1999).

Elaboration: During the elaboration phase, the requirements are detailed and the basic architecture of the system is developed. Here the key aspects of the software are modelled and the core components are designed. The focus is on developing a prototype that reflects the system architecture, which allows design decisions to be validated and provides a solid foundation for full development (Jacobson et al., 1999).

Construction: In this phase, the complete system is developed based on the models and architecture established in the elaboration phase. The software code is written and the different functionalities and components of the system are integrated. The construction is carried out in iterative cycles, which allows for testing and adjusting the functionalities as they are developed, ensuring that the system meets the established requirements (Kruchten, 2000).

Transition: The transition phase focuses on delivering the system to the end user and ensuring that the software is ready for use in a production environment. During this phase, final testing activities, minor adjustments and bug fixes are carried out. In addition, end-user training is provided and the necessary documentation for system maintenance is prepared (Kruchten, 2000).

As defined in the previous paragraphs, UPD was applied for its development, where the objectives were defined in the start-up stage, such as improving the efficiency of project management and facilitating communication between students and teachers. Initial meetings were held with stakeholders (teachers and administrators) to identify the main use cases and the basic requirements of the system. In addition, for a correct understanding of the requirements of the application to be developed from its inception to its conclusion, it is necessary to know everything that corresponds to the processes and their characteristics, such as the personnel responsible, the time allocated to develop each activity, the documentation involved, among other details, designed with specific questions to the role to be interviewed, with the aim of obtaining all the necessary and sufficient information, in addition, in all interview formats a strategic question is placed in the final part, with the aim that the interviewee comments on events, experiences and opinions on activities that have deficiencies and the application can be improved, the question is:

What processes could be improved for a better implementation?

What processes could be improved for a better performance of your activities?

Subsequently, the diagrams that allow to know the complete process that involves the integrating process are made using the technique of problem trees, which allows to identify deficiencies and problems within the process, which can be mitigated through the application to be developed. In addition, three main roles were identified: Administrator, Advisor and Learner. Each of these roles performs specific activities, is associated with different users and has different functionalities implemented within the system. Figure 1 provides a more detailed overview of these roles and their distinctions.

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Box 1

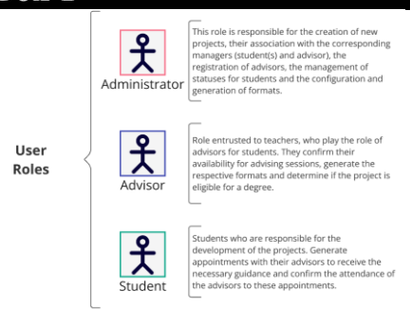

Figure 1
Roles within the system
Source: Own elaboration

A rigorous check on the registration of advisors was put in place to prevent the improper registration of any person as an advisor. In addition, a gender field was integrated to allow the appropriate formulation of the forms according to the gender of the user, including the option to upload the electronic signature in order to optimise the completion of forms as shown in Figure 2.

Box 2

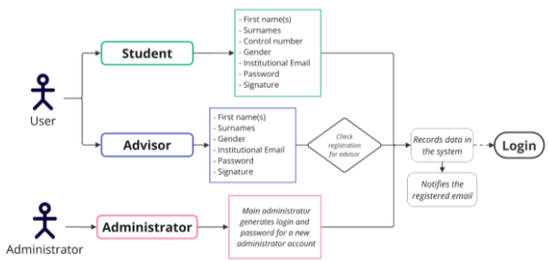

Figure 2
Use cases of system users
Source: Own elaboration

Elaboration

After the initial phase, the development of the system begins, which considers above all its usability, where it first verifies the state of the network, with the aim of ensuring that the activities carried out by the user are not interrupted. In order to quantify and evaluate general aspects of the project, based on the results obtained and to have a greater approximation to certainty in decision-making, indicators were included as shown below. Projects by Area According to the total number of active projects, how many belong to each collegiate group, in order to know the trends and technologies of the development of the projects. See Figure 2.

Box 3

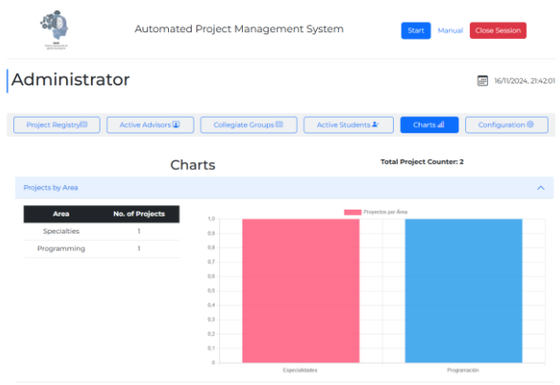

Figure 3
Graphic of projects by area
Source: Own elaboration

Projects by consultant

This shows the total number of active projects, indicating the number of projects that belong to each teacher who is presented as an advisor, in order to measure the workload for each advisor. See figure 4.

Box 4

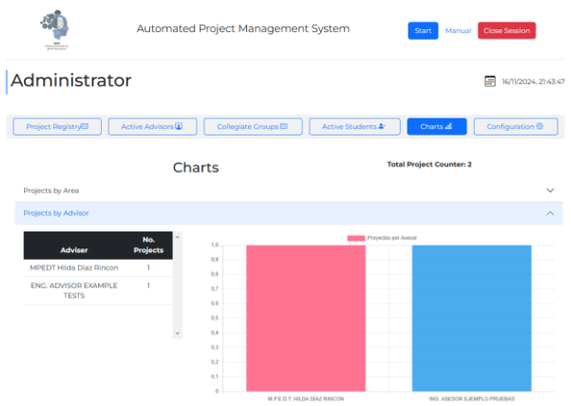

Figure 4
Graph of Projects by Advisor
Source: Own elaboration

Degree projects

According to the total number of active projects, how many of them have been concluded and are suitable for graduation including which ones will not be considered for graduation. See figure 5.

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Box 5

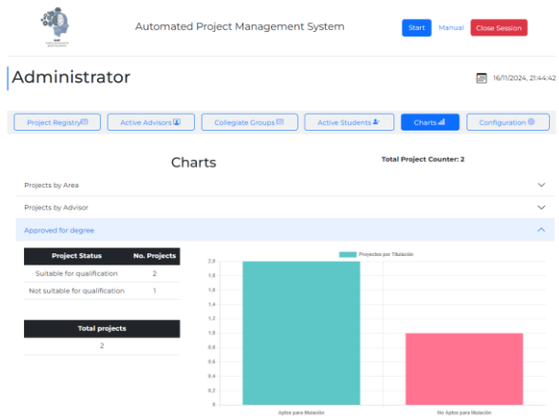

Figure 5
Titling Projects Graphic
Source: Own elaboration

Figure 5
Source: Own elaboration

As part of the description and architecture of the system, the innovative part of the appointment control was integrated as shown in the diagram in figure 6.

Box 6

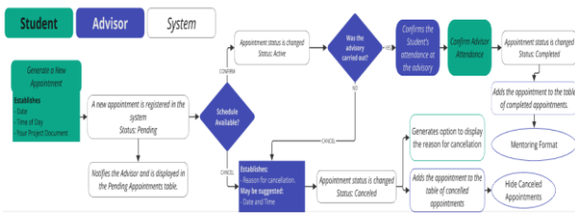

Figure 6
Diagram of citations
Source: Own elaboration

The figure highlights the importance of the learner in generating and finalising the appointment, as it is the end user who determines whether the appointment can be considered as completed. On the other hand, the advisor assumes the responsibility of managing intermediate status changes and being the one who initiates the process of finalising the appointments, which, as mentioned above, the student ends up completing. In the analysis of the system, several tools were identified that contributed to its construction, including languages, software, frameworks, among others. The following table (Table 1) summarises the technologies used throughout the development process.

Box 7

Table 1
Technologies used

NAME	VERSION	TYPE
PHP	8.1.5	Language
JavaScript	-	Language
Bootstrap	5.2	Framework
Xampp	8.1.5	Software
Visual Studio Code	1.84.2	Software
Figma	Web	Design tool
Trello	Web	Work management tool

Source: Own elaboration

Construction

In this phase, system development was completed using the tools listed in Table 1. The construction was done in an iterative manner, allowing for continuous testing and adjustments as new functionality was added, ensuring that the system met the requirements and provided an effective user experience. Within this phase, the system was first implemented locally to perform the necessary tests for validation and functionality for subsequent implementation on a production server.

Transition: Finally, the system was deployed on a production server and made available to end users. During this phase, final acceptance tests were carried out, minor bugs were corrected and users were trained in the use of the system. User documentation was prepared, identifying the role of the administrator, assessor, student and technical manual for the installation of the system, and maintenance procedures were established to ensure the continued operation of the system. In addition, a QR code was included for system monitoring, including a form for students, to be applied after an informative talk on degree alternatives.

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https://doi.org/10.35429/JM.2024.8.14.1.11

Box 8

Figure 7
QR code for access to student form
Source: Own elaboration

Box 9

Figure 8
Initial user registration screen
Source: Own elaboration

The first interface is the start interface which, in addition to the user registration, requests the digital signature that must be included to validate the different formats found within the IMS based on ISO9001:2015 and I know that they are certified by it. See figure 8.

At the end of your registration and depending on the type of user, you will be shown the different modules you can access. Some of the interfaces of the system are shown below.

Box 10

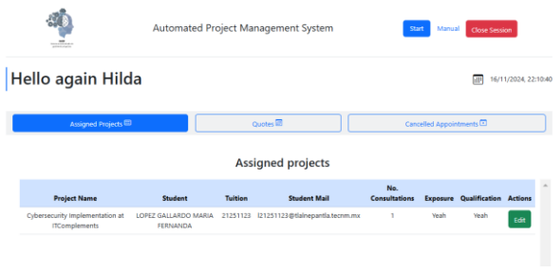

Figure 9
Advisor module overview
Source: Own elaboratiom

This figure 9 shows the projects assigned to the advisor, which allows him/her to visualise his/her assigned projects, indicating the number of advisories carried out, if the student has already made his/her presentation and the status if the student was considered for a degree, in addition the advisor can monitor and manage his/her appointments, where this process is shown in the following figures.

Box 11

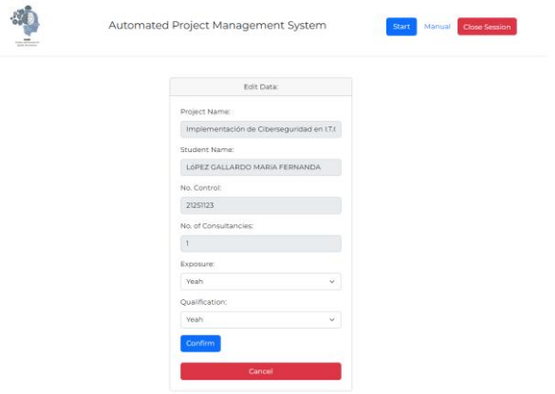

Figure 10
Project registration
Source: Own elaboration

The system allows the data of the projects generated by the students to be entered for their follow-up and, if necessary, their integral degree option. See figure 8. Continuing with figure 11 where you can see the innovation module that allows the management and control of appointments where the advisor and student will have direct communication to improve the efficiency of this. See figure 11.

Results

As part of the modules that make up the system, they are shown in the following figures.

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Box 12

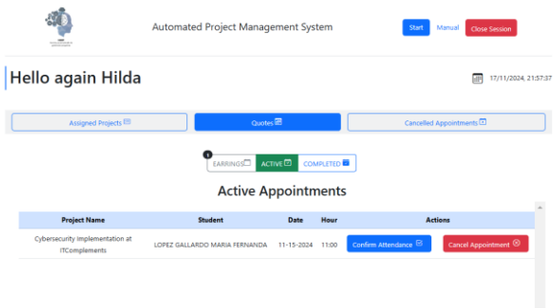

Figure 11
Viewing Active Appointments for the advisor
Source: Own elaboration

In addition, this appointment management, allows to visualise the pending, active and completed appointments for each project assigned to the student as shown in Figure 12, this appointment module also allows the advisor to cancel appointments where he/she will have to indicate the reason for the cancellation as shown in Figure 13 where a section is included.

Box 13

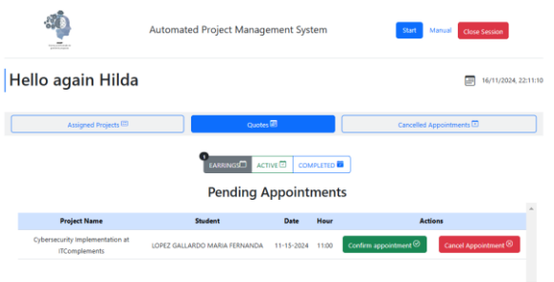

Figure 12
Appointment control by project
Source: Own elaboration

Figure 13 shows how the system indicates the appointments that have been made for each project, so that at the end of the consultancy for each period or whenever desired, the format indicated by the institutional QMS system is generated for the follow-up of the consultancies, thereby optimising delivery times and the student or the advisor not registering it in time and form.

Box 14

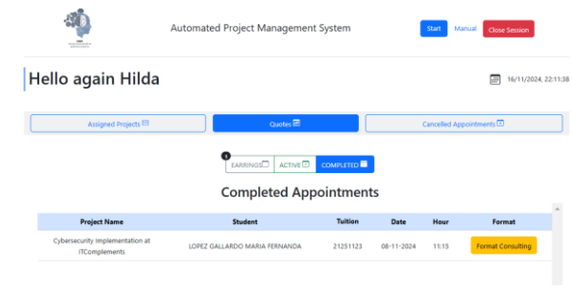

Figure 13
Appointment tracking
Source: Own elaboration

In the following figure 14, you can visualise the format that is generated automatically, which allows to reduce errors and to comply with the indicated in the procedure of the process in accordance with the established in the SGI according to the mentioned norm, as well as the offices and documents that are integrated to the process in an informal way such as the office of assignment of the advisor and the project registration form.

Box 15

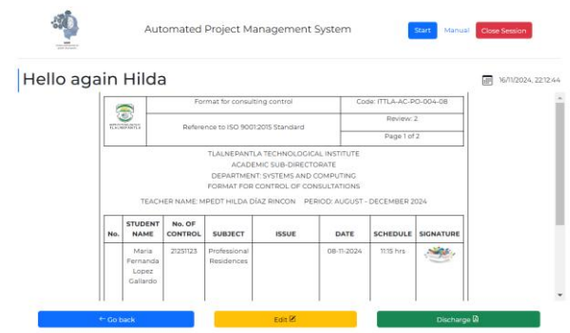

Figure 14
Generation of the Advisory Format in accordance with the QMS
Source: Own elaboration

Students can view their project, the name of their advisor, email and establish communication when scheduling an appointment, as well as see their appointment calendar and its status. See figure 14.

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Box 16

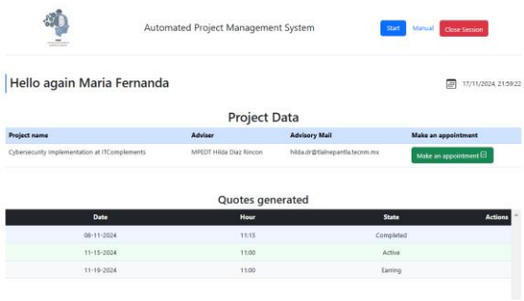

Figure 15
Visualisation of the project as a student user
Source: Own elaboration

For the administrator, this displays the information of the advisors, collegiate groups, students, graphs of indicators and, if necessary, makes changes in the configuration of the different roles that are required. See figure 15.

Box 17

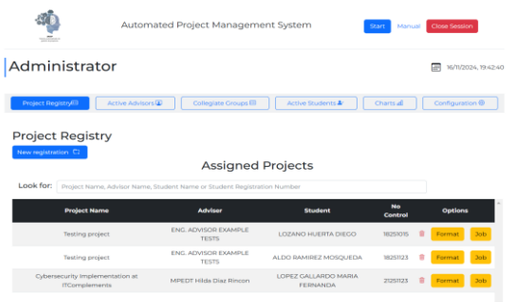

Figure 16
User Administrator displays assigned projects
Source: Own elaboration

Finally, the formats generated automatically by the system are shown, which allow them to reduce errors and comply with the process procedure as established in the IMS in accordance with the aforementioned standard, as well as the offices and documents that are informally integrated into the process, such as the advisor assignment office and the project registration form, see Figure 16.

Box 18

Figure 17
Formats generated by the system
Source: Own elaboration

Conclusions

As an automated solution, the system allowed for a reduction in student service times, in addition to allowing direct communication with the student and their assigned advisor, the system allows for the management of projects from the beginning to the end of the project, including whether the student presents their project, which is a requirement for the integral qualification of the integration process, the system allows for monitoring whether the advisor and the student are in communication, obtaining a report of the appointments made and with the indicators generated by the system, the corresponding area has elements to disseminate and establish the monitoring of the degrees generated by this option, so that the student also verifies that he/she is being continuously advised by the advisor.

As part of the continuous improvement, the system complies with the accrediting body's request to establish mechanisms to improve communication with the student, which is why some of the benefits obtained from the development of the system are listed below.

Technological tools were included for continuous improvement in the corresponding area.

A system was developed that was totally designed to the measures and needs of the requesting area.

Security measures were included from the programming stage, in order to avoid unauthorised access to sensitive information, access through access credentials and security functions specific to the programming language used.

User-friendly interfaces were developed.

The assignment and control process of projects and their advisors was improved.

Metrics (indicators) for better decision making were implemented.

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Article

Proposal of a sustainability model for comprehensive medical centers in the south of the state of Tamaulipas

Propuesta de un modelo de sustentabilidad para los centros médicos integrales del sur del estado de Tamaulipas

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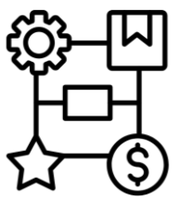
Abstract

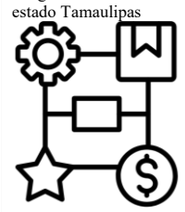
The Spanish language dictionary defines sustainability as "what can be sustained or defended with reasons." Sustainable development is making correct use of current resources without compromising those of future generations. A tool was designed to measure comprehensive medical centers which addresses the three key pillars, environmental, social (sociocultural) and economic, the data obtained was analyzed to generate a sustainability model that allows the aforementioned to move towards sustainable development giving solution to the current problems that affect them, considering all the actions, it is important to mention that the commitment of the parties is required to achieve the objectives.

Objetives	Methodology	Contribution
Generate a proposal for a sustainability model for the comprehensive medical centers in the south of the state of Tamaulipas. 	**A tool was designed to measure the environmental, socio-cultural and economic pillars, with a rating from zero to ten and an average of 20 items for each pillar.** 	**The application of the model will help medical centers improve their operational efficiency and consolidate their commitment to social and environmental responsibility, leading them to be more competitive.** 

Sustainability, Model, Tools

Resumen

El diccionario de la lengua española define sustentabilidad cómo lo "que se puede sustentar o defender con razones". El desarrollo sustentable es hacer un uso correcto de los recursos actuales sin comprometer los de las generaciones futuras. Se diseñó una herramienta para medir a los centros médicos integrales la cual aborda los tres pilares claves, ambiental, social (sociocultural) y económico, los datos obtenidos se analizaron para generar un modelo de sustentabilidad que permita a los mencionados transitar hacia un desarrollo sustentable dando solución a las problemáticas actuales que les afectan, considerando todas las acciones, es importante mencionar que se precisa del compromiso de las partes para el logro de los objetivos.

Objetives	Methodology	Contribution
Generar propuesta de un modelo de sustentabilidad para los centros médicos integrales del sur del estado Tamaulipas 	Se diseñó una herramienta, para medir los pilares ambiental, socio cultural y económico, con una calificación de cero a diez y un promedio de 20 items por cada pilar. 	La aplicación del modelo, ayudará a los centros médicos a mejorar su eficiencia operativa y consolidar su compromiso con la responsabilidad social y ambiental, llevándolos a ser más competitivos. 

Sustentabilidad, Modelo, Herramienta

Citation: Pérez-Pérez, Iris Cristel, Aguirre-Arias, Miriam and González-Gamez, Liliana. [2024]. Proposal of a sustainability model for comprehensive medical centers in the south of the state of Tamaulipas. Journal-Microeconomics. 8[14]-1-7: e30814107.

Introduction

The implementation of sustainable practices is not only important from an environmental perspective, but can also generate economic benefits and enhance the reputation of a company or organisation. In this context, diagnostic tools play a crucial role in helping companies to assess their performance and identify areas for improvement. These tools provide a comprehensive view of current practices and offer specific recommendations to move towards a more productive path. This paper proposes a model that enables the development of comprehensive medical centres in southern Tamaulipas based on organisational sustainability: environmental, social and economic.

Development

In the current context, where concern for the environment and social responsibility are increasingly important, health sector clinics face the challenge of operating in a sustainable manner, minimising their environmental impact, promoting social wellbeing and guaranteeing their long-term economic viability.

To achieve this goal, it is essential to assess the clinic's current performance in terms of sustainability. In this sense, the application of this sustainability assessment tool becomes an indispensable instrument to identify areas for improvement and establish strategies to move towards a more sustainable operating model.

Instrument to be used

The tool used evaluates the environmental, social and economic pillars, only the first items of each pillar are presented.

Sustainability diagnostic tool

Aim of application: To diagnose sustainability in environmental, socio-cultural and economic factors.

INSTRUCTIONS: Ask an employee of the company the following items, elaborated in the form of a question and based on the answer obtained, determine the most appropriate qualification.

Box 1

Table 1
Diagnostic tool

EVALUACIÓN DE FACTOR AMBIENTAL												
No.	ITEMS	CALIFICACIÓN										
		0	1	2	3	4	5	6	7	8	9	10
1	¿Cumple todas las leyes ambientales nacionales e internacionales que aplican al sector?											
2	¿Aplica alguna norma o certificación ambiental (ISO 9001:2015, ISO 13485:2016, Industria Limpia u otra)?											
3	¿Posee una política ambiental formal que es del conocimiento de todos los empleados y consta en el código de conducta y en las declaraciones de valores de la empresa?											
4	¿Su empresa dispone de una política medioambiental formal que incluya un compromiso con el cumplimiento legal, mediciones continuas y mejoras constantes del desempeño en materia medioambiental?											
5	¿Han recibido auditorias por parte de alguna dependencia (SEMARNAT, PROFECO etc.) para verificar el cumplimiento de la legislación ambiental? En caso de que la respuesta sea "si" ¿Como han sido los resultados de dichas auditorias?											

EVALUACIÓN DE FACTOR SOCIO.CULTURAL											
Nº	ITEMS	CALIFICACIÓN									
		0	1	2	3	4	5	6	7	8	9	10
1	¿Considera que es suficiente la atención que se da a clientes?											
2	¿Suben contenido frecuentemente a sus redes sociales?											
3	¿Garantiza el acceso equitativo a servicios de salud de calidad para todos los miembros de la comunidad, independientemente de su origen socioeconómico?											
4	¿La empresa ofrece programas de ayuda social?											
5	¿Se organizan eventos o campañas de concientización en la comunidad sobre temas de salud relevantes?											

EVALUACIÓN DE FACTOR ECONÓMICO												
Nº	ITEMS	CALIFICACIÓN										
		0	1	2	3	4	5	6	7	8	9	10
1	Cumple a tiempo con sus obligaciones fiscales y atiende a las solicitudes de apoyo por parte del gobierno											
2	¿Se cumplen todas las normativas y regulaciones financieras aplicables?											
3	¿La empresa promueve prácticas financieras éticas y responsables en todas sus operaciones?											
4	¿Divulgan información financiera de manera transparente y accesible para sus stakeholders?											
5	¿Se promueve la formación y capacitación continua del personal para fomentar el crecimiento económico y profesional dentro de la empresa?											

Source: Authors' perception.

The tool was designed taking into consideration the three pillars, environmental, social and economic. A medical centre that aspires to be sustainable must take a holistic view that encompasses the environmental, social and economic aspects of its operation.

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They are expected to implement practices and strategies that minimise their environmental impact (responsible environmental management), promote social well-being and ensure their long-term economic viability.

Box 2

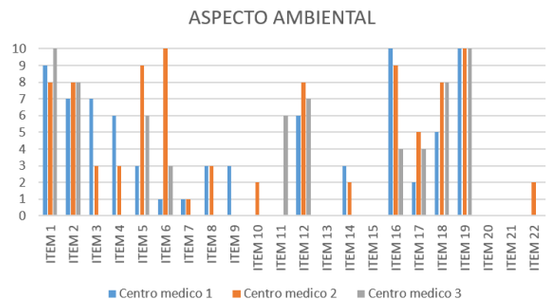

Figure 1
Results obtained from the environmental aspect

Source: authors' perception

Box 3

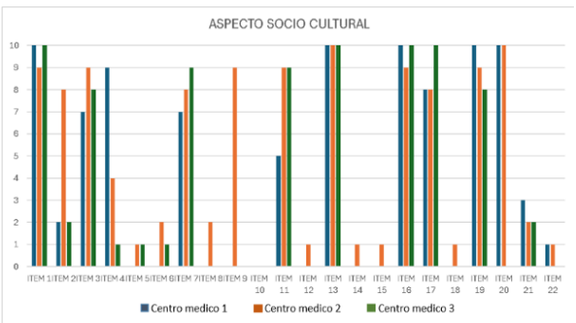

Figure 2
Results obtained from the cultural aspect

Source: Authors' perception

Box 4

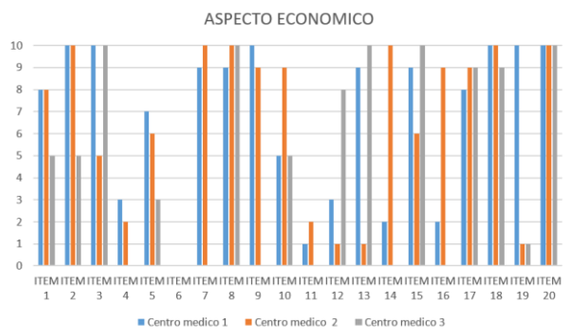

Figure 3
Results obtained from the economic aspect

Source: Authors' perceptions

Proposal for improvement

The proposed model is based on sustainable innovation followed by the three dimensions, environmental, socio-cultural and economic, each identified with a colour, to identify the proposed actions.

Box 5

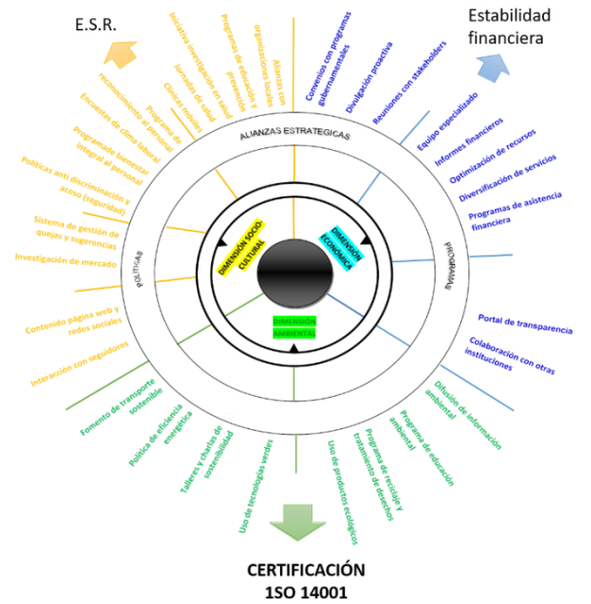

Figure 4
Model for the sustainability of integral medical centres in the south of the state of Tamaulipas

Source: authors' perception

Environmental proposal

1.- Establish an environmental management system In which:

- Optimises the use of resources such as energy, water and materials.
- Minimises the generation of waste and emissions.
- Promotes the reuse, recycling and recovery of waste.
- Implements sustainable purchasing practices.

Implementing

- Recycling and proper waste treatment programmes: to improve medical waste management.

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- Establish an energy efficiency policy in which energy saving measures are implemented:

Establish concrete measures to reduce energy consumption, such as turning off lights and equipment when not in use, using LED bulbs, installing programmable thermostats and conducting regular energy audits.

- **Use of green technologies:** Prioritise the purchase of medical equipment and technologies that are energy efficient and environmentally friendly, thus contributing to the reduction of the environmental impact of the company's operations.

- **Environmental education programmes, awareness campaigns and sustainable workplace practices:** To develop environmental awareness: Promote environmental awareness among staff and the community.

- **Use environmentally friendly products:** Opt for environmentally friendly cleaning products, biodegradable medical supplies and recycled office materials.

- **Provide workshops and talks to staff on the importance of sustainability to** raise staff awareness of the importance of sustainability.

- **Participate in community environmental events and campaigns.**

- **Use internal social networks to disseminate environmental information:** Share news, articles and tips on sustainability on the clinic's internal social networks. As well as publishing its environmental policy on its website and social networks.

2.- Environmental certifications:

Environmental certification, such as ISO 14001 or other recognised certifications, to demonstrate commitment to environmental management and sustainability.

3.- Promotion of sustainable mobility:

Promote the use of sustainable transport among staff, such as carpooling, promoting public transport or encouraging the use of bicycles or walking for short journeys.

Socio-Cultural Proposal

1.- To recognise and reward employees

Through:

- **Staff incentives:** Implement recognition and reward programmes for staff that foster a positive work environment and promote commitment and job satisfaction.

- **Conduct work climate surveys to assess employee perceptions of the organisational environment** to identify areas for improvement and take corrective action, using 'key performance indicators (KPIs)' to measure progress in creating a favourable organisational environment.

- **Implement comprehensive wellness programmes for staff,** including preventive health care, emotional support and professional and personal development opportunities.

2.- preventive policies to prevent incidents

Through:

- Implementing clear policies prohibiting discrimination and harassment in all aspects of human capital management.

- Provide training on occupational health and safety.

Society at large/external

Education and prevention programmes:

Develop educational and disease prevention programmes aimed at the local community, with the objective of promoting healthy lifestyles and reducing the incidence of preventable diseases.

Establish partnerships with local organisations.

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To ensure that all members of the community have access to quality health services, regardless of their economic situation.

5.- Volunteer programmes**:**

To make an active contribution to the well-being of society.

6.- To participate in health research initiatives:

To collaborate with universities and research institutions in carrying out studies on health issues relevant to the community.

7.- To organise health days in low-income communities.

8.- Establish mobile clinics to reach remote communities.

Patients/clients

Accessibility and patient-centred care.

Through:

- **System to receive and manage patient complaints and suggestions,** with the aim of maintaining good customer satisfaction.
- **Conduct market research** to understand patients' needs and expectations.

10.- Create dissemination/marketing

By:

- **Create engaging and high quality content for social media:** Consider platforms such as Facebook, Instagram, TikTok. Post content that is relevant to the target audience and interesting (make yourself more known), using a variety of formats, such as images, videos.
- **Promote interaction with followers** by asking questions and responding to comments on social media.

Proposed economic pillar

Internally:

1.- More effective budget monitoring and control systems:

To achieve financial efficiency by conducting a thorough review of the company's financial processes to identify areas for improvement in the management of costs and expenses.

2.- Profit improvements.

By means of:

- **Specialised work team in the accounting-financial area,** visualising clear objectives.
- **Prepare complete and accurate financial reports:** Prepare annual and quarterly financial reports including income statement, balance sheet and cash flow statement.
- **Conduct presentations and meetings with stakeholders**: Organise presentations and meetings with stakeholders to discuss the clinic's financial results.
- **Resource optimisation:** Implement measures to optimise the use of financial, human and material resources, looking for ways to maximise efficiency and reduce waste in all areas of the company**.**

Financial transparency

Through:

- **Establish a financial disclosure policy:** Develop a clear and concise policy that defines what financial information will be disclosed, how often and how it will be communicated. The policy should be aligned with applicable rules and regulations.
- **Financial transparency portal:** Create an online portal dedicated exclusively to financial disclosure. This portal would be accessible to the general public and would contain annual financial reports, quarterly reports, earnings presentations, and any other relevant information on the company's financial situation.

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- **Proactive disclosure**: Adopt a proactive disclosure policy, in which the company not only discloses financial information required by law, but also voluntarily shares other relevant financial data that may be of interest to stakeholders.

4.- strategic alliances:

Through

- **Establish strategic alliances with other medical institutions**, healthcare providers and related companies to share resources, knowledge and best practices that benefit both parties.

External/clients

Collaboration with other institutions:

The clinic can collaborate with other institutions in the community, such as schools, businesses and non-profit organisations, to develop programmes and projects that benefit the community. In this way, this collaboration can help to make better use of resources and achieve greater impact.

Develop financial assistance programmes:

Offer discounts on medical services for low-income or uninsured patients. And establish flexible payment plans that fit each patient's budget.

Diversification of services:

Explore the possibility of expanding the range of services offered to adapt to changing market needs and diversify revenue streams.

Financial assistance programmes:

Establish financial assistance programmes that provide support to financially vulnerable patients, such as discounts on medical services, flexible payment plans or fee waivers for those unable to pay.

9.- Agreements with government programmes:

Enter into agreements with government health programmes to ensure that financially vulnerable patients have access to basic medical services and medicines at affordable or free prices.

Conclusions

The implementation of the proposals for improvement of medical centres, structured in the environmental, socio-cultural and economic sectors, will not only strengthen their internal operation, but also enhance their positive impact on the community and the environment. In the environmental sector, adopting an Environmental Management System and obtaining certifications such as ISO 14001 as medical centres committed to sustainability, reducing operating costs and improving their reputation. Socio-cultural initiatives, including staff empowerment and community engagement, will promote a healthier and more motivated work environment, while contributing to the general welfare of society through educational programmes, partnerships and volunteering. Finally, in the economic sector, the implementation of transparent financial systems, optimisation of resources and diversification of services will ensure robust and sustainable financial management, benefiting both patients and stakeholders.

In conclusion, the tool helps us to develop the aspects of a growing company that need to be evaluated or to know the ways in which it can perform better.

By integrating these strategies, you will not only improve your operational efficiency and market competitiveness, but also strengthen your commitment to social and environmental responsibility, creating a lasting and positive impact on your community and the environment. This comprehensive transformation will position the medical centres in southern Tamaulipas as market leaders.

Author contribution

This project was carried out as a team, in this way the members of the team collaborated in each of the developed stages, from the methodology to the generation of the proposal. The application of the tool was carried out by the author and the second co-author.

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Availability of data and materials

As they are private organisations, the information of the participating staff was harmonised, some data is not shared: initials and name, personal data.

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Basics

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Article

Influence of training on productivity. A study in micro service companies

Influencia de la capacitación en la productividad. Un estudio en microempresas de servicios

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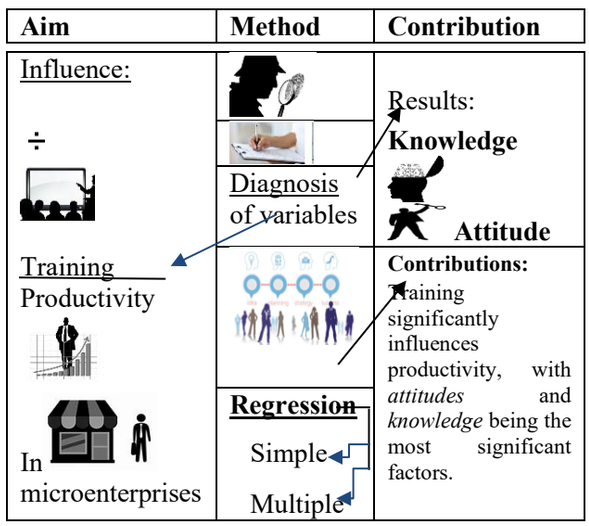
Abstract

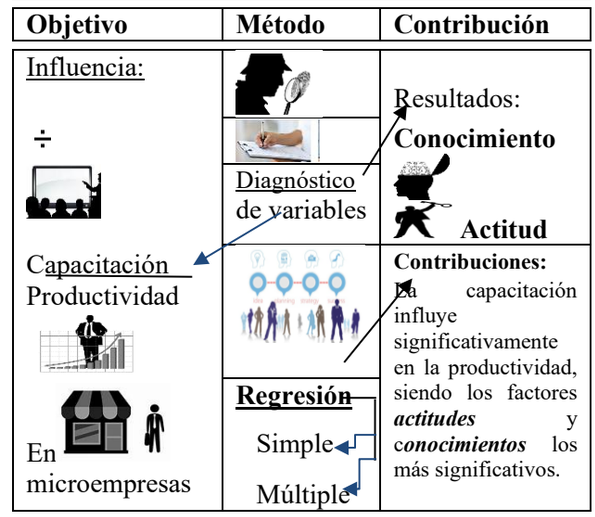
Nowadays, micro-enterprises face constant challenges to maintain their efficiency and competitiveness, where a large part of this responsibility falls mainly on the performance and efficiency of the workers. Given this situation, it is important that the productivity of the employees is continuously stimulated, with training being one of the options. Therefore, the aim of this research was to determine the influence of training on the productivity of workers in service micro-enterprises. To this end, a diagnosis was made on the perception of the variables training and productivity, analyzing the results obtained through inferential statistics. The results showed that the attitude to receive training and the knowledge acquired significantly influence the productivity of workers. It is concluded that micro-enterprises must provide continuous training to their workers in order to provide them with more tools to stimulate their productivity and work performance, as well as their personal and professional development.



Training, worker productivity, SMEs

Resumen

Hoy en día, las microempresas enfrentan desafíos constantes para mantener su eficiencia y competitividad, donde gran parte de esta responsabilidad recae principalmente, en el rendimiento y desempeño los trabajadores. Ante esta situación, es importante que la productividad del personal sea continuamente estimulada, siendo la capacitación una de las opciones. Por ello, el objetivo fue determinar la influencia de la capacitación en la productividad de los trabajadores en microempresas de servicios. Para tal fin, se realizó un diagnóstico sobre la percepción de las variables capacitación y productividad, analizando los resultados obtenidos por medio de estadística inferencial. Los resultados revelaron que la actitud para recibir capacitación y los conocimientos adquiridos influyen significativamente en la productividad de los trabajadores. Se concluye que las microempresas deben dar capacitación continua a sus trabajadores para brindarles mayores herramientas que estimulen su productividad y desempeño laboral, así como su desarrollo personal y profesional.



Capacitación, productividad del trabajador, mipymes

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Introduction

Nowadays, the lack of employee training is one of the main problems seen in micro and small organisations, a situation that has a direct impact on the low performance of their activities. When measuring the relationship between productivity, results and resources used, this is directly related to the training that organisations provide to their employees (Newstrom, 1993). Training ensures the quality and improvement of tasks and achieves greater specialisation in workers (Government of Mexico, 2018), thus optimising resources and achieving better results. Coparmex (2022) mentioned that the development of new knowledge, skills and attitudes in employees will improve productivity in companies. In addition, he stated the urgency of raising awareness among employers so that they recognise the need for highly qualified staff as a competitive advantage.

Similarly, Obando (2020) mentions that training will have a positive impact on employees and increase their commitment to the activities carried out, since in this way they will be empowered to perform their activities with greater ease, so that they have the necessary and appropriate skills that will enable them to achieve the short and long-term objectives of their work unit and the company in general.

Therefore, in this research, the following research question was posed: How does training influence the productivity of workers in micro service enterprises and the research objective: to determine the influence of training on the productivity of workers in micro service enterprises.

Literature review

Training

Training is conceived as a learning process that is applied in a systematic and organised manner, through which people acquire knowledge, skills and attitudes to efficiently perform their tasks and, as a result, achieve the objectives defined for their position (Chiavenato, 2007). For companies, this set of competences represents an investment in their human capital, as it allows them to strengthen aspects that are important for their work performance.

The objective of training focuses on teaching new apprentices (Rodríguez, 2002), as this allows for the adaptation of personnel for the exercise of a specific task within an organisation. In addition, training prepares people for their position and at the same time provides them with opportunities for continuous professional development, ensuring that they not only learn about the activities within their current position, but also allows them to acquire tools to perform more complex and higher functions, preparing them for new jobs or promotions (Chiavenato, 2011).

Training not only represents a useful tool to help and teach staff, making them capable of performing effectively in their jobs, but also helps them to change people's attitudes on various issues, and this in turn will lead to a more satisfactory climate within companies, increasing their motivation and making them more receptive to new management trends. The purpose of training is to help staff at different organisational levels to achieve their and the company's objectives, through continuous learning that allows them to improve and provide quality in the tasks performed, avoid and reduce downtime, avoid rework (Yon, 2022), solve problems with different vision and motivate staff in terms of personal and professional growth (Government of Mexico, 2018) that serves as a type of emotional retribution and causes satisfaction to workers about their job growth.

Sanchez (2023) says that another benefit of training is to provide security and self-esteem to workers, as providing adequate safety training will help them to identify occupational hazards in a timely manner, which will reduce the possibility of accidents in work areas, impacting on creating a work environment that will give security and confidence to staff, a situation that will improve productivity in microenterprises. And this, in turn, is related to specialisation and flexibility when carrying out their tasks, because if risks are avoided and prevented, carrying out an activity will be simpler and easier, obtaining greater performance for the company.

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On the other hand, employers benefit from training, as it will increase productivity and consequently business profitability, raise staff morale, increase the knowledge and performance of the different jobs, improve the company's image, achieve greater identification of staff with the company and thus seek to achieve the objectives of this, improve the relationship between boss and employees, provide information on prospects for staff development in the company, also training helps to develop different solutions in their workers to problems of the organisation (Cota and Rivera, 2017).

Nowadays, training is considered a strategy for the growth of SMEs, as nowadays it has an impact on strengthening the productivity of an SME. Training human capital improves productivity and consequently business competitiveness (Salazar, 2013) and, at the same time, allows them to achieve innovation in the activities they perform because it gives workers the opportunity to participate and develop thinking to create solutions to the problems that arise in their activities (Cota and Rivera, 2017).

In addition, by training workers, companies must understand that through this process they are able to compete in the market and create or participate in the training programmes that are carried out with planning directed towards the company, contributing to its economic development and being an alternative for sustainable development (Granados et al., 2018).

Productivity

According to Moreno et al., (2009) the purpose of training is to increase productivity and production by increasing the knowledge of human capital. In addition, it will help to develop team equipment, increase job satisfaction and increase safety and hygiene patterns at work, optimise the use of materials and standardise procedures (Moreno et al., 2009).

Productivity, according to Bojórquez and Bojórquez (2013), is understood as the relationship between what is produced and the resources used, considering facilities, machines, tools, human knowledge and services. In this part, Porro (2020) explains that the division of labour for the efficiency of labour is caused by the characteristics of workers, the development and innovation that affects the skill of human capital in saving time and the implementation of machinery that facilitates the work. In addition, effective communication, provided during training will foster communication and that will lead to a grouping of the work team that improves relationships increasing the quality of work (Hernández, 2023). INEGI (2015), in the productivity indices obtained in the National Survey on Productivity and Competitiveness of Micro, Small and Medium Enterprises indicated that when there is an increase in productivity, this is due to the increase in volume production with the same amount of resources used.

Robbins and Judge (2013) consider competitiveness to be the highest level of analysis in organisational behaviour by relating the human behaviour variable of producing more at the lowest cost. Productivity, therefore, requires both effectiveness and efficiency, as the firm becomes effective when it achieves its goals. Preparing the staff will cause this effectiveness in the optimisation of the performance of tasks, because by implementing a training plan, the company will have trained staff to achieve organisational objectives, so it insists on the continuous training of human resources as an investment that will become a future gain for employers (Gómez, n.d.).

Since, the more experience, which is generated through training, will make the staff more efficient by providing job training to know their trade and activities and itself, making the worker aware of the results that are expected of him, (Gomez, n.d.) making him understand that this goes from a higher commitment and a greater sense of well-being at work that can directly impact on their performance levels.

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Hernandez (2023) mentioned that training and human capital development will help to develop professional skills of human capital to perform their work by keeping them updated through programmes that allow them to develop favourable competencies that serve the company's purpose. By maintaining a direct relationship with job performance, training generates clear and defined processes that are integrated with the objectives of the company, so that they achieve better personal and professional development of the worker in the workplace, and thus enhance their capabilities (Cárdenas, 2017) in order to provide and support their job growth through the establishment of a work process in which adequate performance is rewarded and employees are aware of the existing growth opportunities (Hernández, 2023).

Today, there are programmes that offer training to employers and/or workers. One of them is the programme created by the Mexican government; Jóvenes Construyendo el Futuro, which aims to support companies to incorporate young people into their workforce, contributing to the economy of the beneficiaries and their families through training (Government of Mexico, 2022). Within this programme, employers act as tutors and participating in this platform benefits them by promoting training in the workplace, providing professional experience to young people while receiving free labour (since the payment for the service provided is made by the government) and, in addition, their company becomes distinctive as a company with social commitment. Young people between the ages of 18 and 29 who are not studying and working can participate in this programme as apprentices, where they are trained and develop new work skills, in addition to receiving financial support, they receive a training certificate and medical insurance from the Mexican Social Security Institute on behalf of the company. At the press conference on behalf of the STPS in 2022, Martha Bolaños López, indicated that this programme has enabled many young people to be trained in the workplace and has also served as an advantage for more than 140,000 companies to use young talent and increase their productivity.

Methodology

In this research, a mixed type of research was carried out with a descriptive, explanatory and transversal scope, considering worker training and productivity as study variables. Based on theory, the dimensions analysed in the training variable were learning processes (Chiavenato, 2007), competencies (Chiavenato, 2011), and motivation (Yon, 2022). In the worker productivity variable, competitiveness (Robbins and Judge, 2013) and performance (Hernández, 2023) were analysed as dimensions.

A 36-item questionnaire was designed for the study. In the measurement of each item, an interval metric measurement scale was applied, using the Likert method, considering five response categories with metric units from 1 to 5, where 1 was specified as ‘not at all determinant’, 2 ‘not very determinant’, 3 ‘indifferent’, 4 ‘determinant’ and 5 ‘very determinant’. For the application of the instrument, micro service enterprises (1 to 5 workers) in the State of Tlaxcala were considered. The reliability of the instrument was calculated using the Cronbach's Alpha index under the criteria of Hernández-Sampieri and Mendoza (2018). Subsequently, we proceeded to the inferential analysis of the information. For this, a simple linear regression model was performed to determine the influence of the predictor variable ‘training’ on the dependent variable ‘worker productivity’, and a multiple linear regression model to determine which training factors directly influence ‘worker productivity’. Finally, the results obtained are presented for discussion, followed by the conclusions drawn from the research.

Results

The instrument was applied in 30 service microenterprises, collecting a total of 60 instruments, 1 for the management (owner) and 1 for the workers in each microenterprise. The reliability of the diagnostic instrument, according to Cronbach's Alpha coefficient, was 0.879, which represents an acceptable reliability (Hernández-Sampieri and Mendoza, 2018).

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Based on the information collected by the instrument, simple and multiple regression models were calculated to determine the influence of the predictor variables on the dependent variable. Tables 1 and 2 present the results obtained.

Box 1

Table 1
Simple linear regression model

Productivity	R=.752	R^2 =.566	R^2c=.559	F=75.662
	Unstandardised coefficients		Typified coefficients	p=.000
	B	Error	Beta	Sig.
Constant	-.313	.508		.540
Training	1.036	.119	.752	.002

Source: own elaboration

Box 2

Table 2
Multiple linear regression model

Productivity	R=.859	R^2=.737	R^2c=.701	F=20.443
	Unstandardised coefficients		Typified coefficients	p=.000
	B	Error	Beta	Sig.
Constant	.401	.872		.648
Attitudes	.682	.108	.519	.000
Knowledge	.290	.066	.399	.000
Systematic process	.154	.083	.146	.070
Professional satisfaction	.098	.063	.122	.128
Skills	.066	.078	.068	.399
Job security	.046	,066	.053	.490
Organised process	.031	.051	.052	.545

Source: own elaboration

From table 1, the simple regression model showed a coefficient of determination ^{R2}=0.566 and p=0.000, which indicates that the predictor variable explains 56.6% of the model and that the model is statistically significant, making the model viable. The typed coefficient Beta of the training variable presented a value of 0.737 and p=0.000. This shows that the predictor variable significantly influences the dependent variable by 75.2%.

In relation to the multiple regression model presented in Table 2, the results indicate that it is viable, since its corrected ^{R2}was 0.701, indicating that the predictor variables explain 70.1% of the model and that at least one directly influences the dependent variable, being significant with a value of p<0.05.

Looking closely at the standardised Beta coefficients, it was identified that the factors attitudes and knowledge had an influence of 51.9% and 39.9% on the dependent variable, being statistically significant. The rest of the factors showed a weak influence, being only representative for the variable 'worker productivity'.

The results obtained from the inferential analysis show that training does have a significant influence on worker productivity, with attitudes and knowledge being the most significant factors.

In the first instance, it is highlighted that the attitude of the worker to be willing to undergo continuous training, to be evaluated and to receive feedback from their superiors is a determining factor in their productivity. Maintaining a mentality that is resistant to change limits the personal and professional development of each individual, limiting their professional development. This leads us to understand that organisations should promote strategies to make staff understand the importance of receiving training, explaining clearly the advantages and benefits it represents. A passive and reluctant attitude to receive training promotes low productivity, as staff often prefer to consider themselves indifferent and even avoid continuing their professional development, given the idea that by receiving training they will be subjected to more work and greater demands. At this point, a good quality of communication and the creation of meaning for each activity are important to achieve a positive and favourable attitude towards organisational processes such as training programmes (Rodríguez et al., 2018).

On the other hand, among the many benefits of training, one of the most important is to continue to expand knowledge, improve existing skills and develop new ones (Government of Mexico, 2018). It is therefore crucial that workers have the necessary knowledge to perform their jobs properly and efficiently, that they know how to safely and skillfully operate tools or machinery required for their performance, and that training is provided under the same principles of equality for both long-standing staff and new recruits.

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In the globalised world, the organisations that stand out in the markets are those that have highly qualified personnel, with the appropriate knowledge for decision-making and problem-solving (Bermúdez, 2015). This will allow the organisation to generate more income and higher productivity because workers feel confident with what they know and how they do it, which will give them the security to contribute new ideas to achieve the objectives and high quality in their work and performance, which will allow them to excel in the work environment (Obando, 2020).

In addition, training will also be decisive in boosting staff productivity if the frequency with which it is carried out is continuous, if its formalisation is in accordance with planning, if its development is based on the real needs of the staff and if the trainer or training entity generates confidence and good expectations. In addition, nowadays, it is crucial for any organisation to train on safety at work. All personnel must know the safety rules and the risks to which they may be subjected in the workplace, and it is important that the training is given to everyone, highlighting also the importance of everyone complying with the rules without exception.

Finally, job satisfaction is largely achieved through the personal well-being of the worker. This implies being at ease with the work environment, with the work dynamics and with the recognition received for good performance. Highly competitive organisations are those whose staff are at ease and highly motivated, aspects that allow them to adapt to the changes and demands of the market, promoting a more humanised staff, with a high potential for teamwork and a greater capacity for resilience (Bermúdez, 2015). Therefore, training should also be oriented towards an integral wellbeing that includes the promotion of the worker's mental health, which, in turn, will pay off in better performance, higher productivity and good business profitability (Quiroz et al., 2020).

Conclusions

Training will continue to be a topic of interest in the business world due to the social and economic impact it generates not only for companies, but also for workers and their environment.

The competitiveness of an organisation depends to a large extent on the productivity of its human capital and how well it is trained to perform its work with quality. For this reason, it is essential to develop training programmes, especially in micro, small and medium-sized enterprises, which represent the mainstay of the country's economy.

On the other hand, it is important to establish that training should be carried out according to the needs of the workers and their job. This principle will help staff to be more efficient in their activities and to specialise over time, thus meeting the objectives specified for their area of work and, at the same time, those of the company.

Managers and owners must see training as an investment for their company. Unfortunately, in MSMEs it is common that they do not see it this way, being more of an empirical process than a systematised one. Therefore, it is crucial that governmental, public and educational institutions actively participate in guiding organisations on the benefits of well-planned and structured training.

Achieving higher productivity and remaining competitive is becoming increasingly complex for all sectors. Society has new needs, technological development is growing at an ever-increasing rate, and available resources are becoming fewer and fewer. Against this backdrop, the best option for organisations to survive and endure over time is to keep their staff trained and updated, which will undoubtedly keep them at high levels of productivity and prepared to face the new challenges that lie ahead.

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.

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Authors' contribution

Sarmiento-Paredes, Susana: Contributed to the development of the research, in the development of the theoretical framework, design and application of the instrument, analysis of results, supervision and writing.

Carro-Suárez, Jorge: Contributed to the development of the research, inferential analysis, analysis of results and writing.

Nava, Doroteo: Contributed to the development of the theoretical framework, design and application of the instrument and analysis of results.

Larios-Gómez, Emigdio: Contributed to the development of the theoretical framework, design and application of the instrument and analysis of results.

Availability of data and materials

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Abbreviations

Coparmex	Employers' Confederation of the Mexican Republic
INEGI	National Institute of Statistics and Geography
mipymes	Micro, small and medium-sized enterprises
STPS	Ministry of Labour and Social Welfare

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Article

Consumption of armed catfish (*Hypostomus plecostamus*) in the municipality of centro, Tabasco

Consumo del pez bagre armado (Hypostomus *plecostamus*) en el municipio del centro, Tabasco

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Abstract

El bagre armado, conocido también como pez diablo (*Hypostomus plecotomus*), ha sido objeto de controversia en Tabasco debido a su impacto en la pesca local. Sin embargo, es importante aclarar que esta especie no es considerada invasora en el sentido estricto, ya que su presencia en la región se debe a su introducción deliberada y no a una invasión natural. Especie introducida a Tabasco en los años 2000 se ha convertido en una verdadera preocupación por su rápida expansión en las aguas de ríos y lagunas https://www.cyd.conacyt.gob.mx/archivo/247/Articulos/BagresArmados/Bagres1.html. La investigación tiene como objetivo el análisis del consumo y formas de degustación de manera integral del pez Bagre Armado (*Hypostomus plecostomus*) en el municipio del Centro, Tabasco. Esta investigación se enfoca en los resultados obtenidos sobre su consumo y beneficios. Esto permitirá incentivar su valorización en las comunidades y habitantes del municipio del centro, y promover su consumo responsable como recurso alimenticio. La metodología empleada incluye un enfoque descriptivo. Se realizaron encuestas a 2,458 habitantes del municipio del centro por medio de la aplicación FORMS OFFICE®, para evaluar las percepciones de la comunidad sobre consumo, conocimiento, formas de degustación del pez bagre armado. En los resultados obtenidos se comprobó que existe conocimiento del pez bagre armado por parte de los habitantes del municipio del centro repercutiendo en su consumo. La investigación contribuye a promover su consumo de un recurso subutilizado que tiene un potencial significativo para mejorar la alimentación y diversificar la dieta de las comunidades y habitantes y generar nuevas oportunidades para los pescadores y las comunidades rurales. Así como al fomentar una cultura de consumo responsable y sostenible, al integrar a la comunidad en el pez bagre armado y minimizar su impacto ambiental en la región.

Consumo, Conocimiento, Pez bagre armado

Resumen

Armed catfish, also known as devilfish (*Hypostomus plecotomus*), has been the subject of controversy in Tabasco due to its impact on local fisheries. However, it is important to clarify that this species is not considered invasive in the strict sense, since its presence in the region is due to its deliberate introduction and not to a natural invasion. A species introduced to Tabasco in the 2000s, it has become a real concern due to its rapid expansion in the waters of rivers and lagoons https://www.cyd.conacyt.gob.mx/archivo/247/Articulos/BagresArmados/Bagres1.html. The objective of the research is to analyze the consumption and ways of tasting in a comprehensive way of the Armored Catfish (*Hypostomus plecostomus*) in the municipality of Centro, Tabasco. This research focuses on the results obtained on its consumption and benefits. This will encourage its valorization in the communities and inhabitants of the downtown municipality, and promote its responsible consumption as a food resource. The methodology used includes a descriptive approach. Surveys were carried out with 2,458 inhabitants of the downtown municipality through the FORMS OFFICE® application, to evaluate the community's perceptions of consumption, knowledge, and ways of tasting armed catfish. In the results obtained, it was found that there is knowledge of armed catfish by the inhabitants of the municipality of the center, which has an impact on its consumption. The research contributes to promoting their consumption of an underutilized resource that has significant potential to improve the diet and diversify the diets of communities and inhabitants and generate new opportunities for fishers and rural communities. As well as by promoting a culture of responsible and sustainable consumption, by integrating the community into the armed catfish and minimizing its environmental impact in the region.

Consumption, knowledge, armed catfish

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Introduction

According to the authors [Mendoza, 2007] R. Mendoza, S. Contreras, C. Ramírez, P. Koleff, P. Álvarez, V. Aguilar. Devilfish: high impact invasive species. Biodiversitas, 70 (2007), pp. 1-5 was introduced into Mexico, in 1995 for the first time making its appearance in Pez diablo in the Mezcala river, in the Balsas river basin. Subsequently recorded in Tecpatán, Chiapas.

Species introduced to Tabasco in the 2000s in the waters of rivers and lagoons

Mainlyin the Grijalva and Usumacinta river basin, as well as in several localities near Villahermosa Tabasco. During the last three years, the armoured catfish has expanded rapidly. It is now common to find them in several of the country's largest watersheds. This phenomenon has been characterised by a high rate of dispersal and a significant proliferation of their populations, causing a sudden abundance of juvenile organisms, demonstrating the establishment of their populations in the new sites.

The armoured catfish (*Hypostomus plecostomus*) is a species of freshwater catfish belonging to the family Loricariidae, known for its resilience and adaptability to diverse aquatic environments native to the Amazon basin, this fish has been introduced into numerous water bodies outside its natural range, where it has had significant ecological impacts (Weber, 1992; Armbruster, 2004; Nico et al., 2009; Winemiller & Jepsen, 1998).

Because of its 'armoured' appearance. Also known as armoured catfish. It is characterised by its ability to attach to surfaces thanks to its sucker-like mouth, which it also uses to feed on algae and detritus at the bottom of water bodies (Weber, 1991). Hypostomus plecostomus has a robust, elongated body, covered with bony plates that form armour, a distinctive feature of loricariids. Armbruster (2004) and Weber (2003) agree that robustness and body length are evolutionary adaptations for life in fast currents and for protection against predators.

The armoured catfish is a species that feeds on green algae generated in bodies of water, which rules out the possibility that it consumes excrement and fish roe, according to scientist Carlos Martínez Palacios (Ramírez J. H., 2017).

At first it was believed that it fed on mojarras, however, nothing could be further from the truth. The devil fish, or armoured catfish, is herbivorous, feeding on algae and debris. In fact, one of its many nicknames is 'Fishbowl cleaner'. (León S. M., 2017).

Most of the myths, in addition to its physical appearance, unattractive to some, generated a generalised rejection of the species. In 2006, at the request of the fishermen to the municipal presidents of Churumuco, La Huacana, Arteaga and Mújica, in Michoacán, CONACyT, through the Mixed Fund and supported by resources from the three levels of government, issued a national call for proposals to solve the problem. Within this call, the Aquaculture and Aquaculture Biotechnology group of the IIAF of the UMSNH proposed a project, which was approved with 2.4 million pesos, called 'Technological Development for the Use and Industrialisation of the Devilfish in the Bajo Balsas, in Michoacán'.

The project brought together researchers from nine institutions and two dependencies of the UMSNH: UNAM Campus Juriquilla, UAQ, UABC, University of Maringá, Brazil, University of Stirling, from the United Kingdom and the Research Centres CIAD Hermosillo, CINVESTAV-Mérida and CICIMAR-IPN, forming an academic and interdisciplinary group that brought together six researchers Level III of the National System of Researchers, as group leaders. The main result of the research, which lasted two years, was that the best way to control and take advantage of this resource was through the human consumption of armoured catfish (Martínez Palacios et al., 2010a; 2010b; Ramírez-Suárez et al., 2012). To this end, several public tastings were held at gastronomic fairs, as well as a book of 50 recipes collected in Colombia, Venezuela and Brazil, where this fish is a premium product.

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The book, entitled 'Nutrition with flavour. Delicias del pez diablo' (Martínez-Palacios et al., 2009) was published by the UMSNH and presented at a tasting for Mexican chefs at the Los Mirasoles restaurant in the city of Morelia. Subsequently, in 2012, with the support of the National Fisheries Institute, a series of courses was initiated for Michoacán, Tabasco, Chiapas and Quintana Roo, to transfer processing technologies and demonstrate the use and consumption of this species. As a result, fishermen accepted the technology and were able to register this new species in the National Fishing Charter to promote its exploitation for human and animal consumption. Consumption refers to the exploitation of this species as a food resource, either by local fishing or commercialisation. In some places it has begun to be valued for its nutritional properties. Its consumption may be driven by initiatives to exploit it as a source of protein or to control its environmental impact. In Villahermosa, the capital of Tabasco has a long fishing tradition due to its strategic location near several important rivers, such as the Grijalva and the Usumacinta. Fishing has been a vital economic and cultural activity for the region. It was found that research conducted by the Universidad Autónoma de Tabasco UJAT by biologists such as Dr. Rafael Ruiz, his research indicates that, although the catfish, or pez diablo or pleco, is seen as a threat to biodiversity, it has also been integrated into the local culture as a common species in fishing and occasionally in local cuisine. Traditionally, the armoured catfish was not a species of great culinary value in the region. However, due to its abundance and the need to manage its population, local inhabitants began to incorporate it into their culinary practices, giving greater importance to local gastronomy.

The armoured catfish is an accessible source of protein. According to studies by the Universidad Juárez Autónoma de Tabasco (UJAT), its meat is rich in protein and essential minerals, making it a viable alternative to other more expensive and less abundant fish species. The gastronomy of Villahermosa has incorporated the armoured catfish in several traditional dishes Among the most outstanding are: Caldo de Pez bagre: A nutritious broth that is prepared with local vegetables and spices, Grilled catfish**:** Prepared grilled, marinated with herbs and spices from the region, Breaded catfish, prepared marinated and breaded fried.

Some local chefs have experimented with new ways of preparing catfish, combining traditional techniques with contemporary approaches. These efforts have resulted in the creation of dishes that are not only delicious but also sustainable, helping to control the population of this invasive species. The last festival held in Villahermosa, Tabasco on 7 February 2022, organised by the authorities of the municipality of El Centro, was held with the aim of raising awareness of what can be consumed and the ways in which it can be consumed, as well as making it known that it is not really a threat, we can take advantage of it and see it as a business opportunity for the inhabitants of the municipality of El Centro and promote the culture of consumption of the species.

The inclusion of the armoured catfish in the local diet also has a positive impact on sustainability. By consuming this invasive species, it helps to maintain the balance in Tabasco's aquatic ecosystems. Studies by Garcia-Berthou et al. (2007) highlight that the meat of this fish contains a significant amount of high quality protein, comparable to other more commonly consumed fish species.

The meat of armoured catfish is low in saturated fat, making it a healthy option for people looking to reduce their intake of unhealthy fats. According to a study by Ruiz and López (2018) from the Universidad Juárez Autónoma de Tabasco (UJAT), the fatty acid profile of armoured catfish is favourable, with a higher proportion of beneficial unsaturated fats. Omega-3 fatty acids are essential for cardiovascular health and brain development. Research from UNAM (2020) indicates that armoured catfish contains significant amounts of omega-3 fatty acids, which may contribute to reduced risk of heart disease and improved cognitive function.

Research from various academic and scientific institutions supports its inclusion in a balanced diet, highlighting its potential benefits for cardiovascular health, cognitive development and strengthening the bone and immune systems.

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Box 1

Table 1
Sampling of respondents

Age Group	Man	Woman	Total
20 – 24	572	514	1,086
25 – 34	430	278	708
45 – 54	160	202	362
55 – 60	84	92	176
61 – More	41	76	117
Total	1,287	1,162	2,449

Source: *Own elaboration*

The research on armoured catfish presents an innovative approach compared to previous studies, as it focuses on the valorisation of the inhabitants of the municipality of Centro and its communities. Unlike other research that has focused primarily on the control of this species as an invasive, this study highlights its potential as a food and economic resource.

A distinctive aspect of this research is its emphasis on integrating the participation of local communities, thus promoting management based on principles of social and solidarity economy. This approach not only seeks to recognise the value of armoured catfish within an economic context, but also considers the negative knowledge and perspective that communities have about the species. This contrasts with previous research that has prioritised ecological and control aspects, leaving aside the socio-economic importance that the fish may have in the lives of local inhabitants.

The problem is to know the consumption of the armoured catfish in the municipality of the centre of the research is the lack of knowledge, lack of information and community valorisation strategies, which has generated a negative perception of its limited potential for exploitation. The article consists of the following sections. Development of the methodology explains the type of study, the non-probabilistic sampling by convenience was elaborated and a research instrument was applied through Forms Office, as well as the collection of data, presentation of the results by means of graphs and tables with their respective interpretation, conclusions and recommendations.

Methodology

In the methodology to be followed in the research was carried out under a descriptive approach as it is key to accurately document the data, describes in detail the consumption habits, preferences of the inhabitants and methods of preparation, knowledge, forms of tasting and its potential to consume the armed catfish in the municipality of Centro, the study population are the inhabitants of the municipality of Centro, Tabasco which consists of 683 607 inhabitants *(INEGI. Census of Population and Housing 2020)*.

The sample includes 2458 participants from the municipality of Centro selected through non-probabilistic convenience sampling: The sample is chosen according to the convenience of the researcher, it allows him to arbitrarily choose how many participants can be in the study *(Hernández González, Osvaldo, 2021)*.

The sample guaranteed the representation of different socio-economic groups, age, sex, socio-economic level, for the collection of data structured surveys consisting of 13 closed multiple-choice questions were applied by means of the application of Forms Office Microsoft to the inhabitants of the municipality of Centro, Tabasco,

The central hypothesis of this research is that 'the level of knowledge about armoured catfish *(Hypostomus plecostomus*), food consumption and ways of preparation is related to the negative perception of the species. However, by promoting education about its consumption characteristics, forms of preparation and marketing possibilities, it is possible to change this perception and encourage responsible consumption. This change would not only generate economic gains for fishing communities, but would also diversify the food supply and contribute to controlling the environmental impact of this species.

In this hypothesis, the dependent variable is the *knowledge* of existence derived from the lack of information on the biological characteristics and benefits of the fish. The independent variable is *Negative Perception*, based on the belief that it is a poisonous, non-consumable and unattractive looking species.

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Results

In the analysis of the data the central hypothesis of this research states 'the level of knowledge about armoured catfish (*Hypostomus plecostomus*) food consumption and ways of preparation is related to the negative perception about the species, in the municipality of the centre. The results obtained throughout this research allowed us to identify the level of knowledge that the inhabitants of the municipality of El Centro have about the armoured catfish, how much they consume it, as well as their general perception of this species. These are presented below. Data related to knowledge (dependent variable)

Box 2

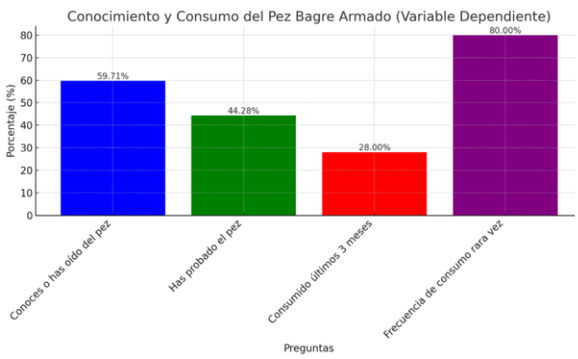

Figure 1

- Do you know or have you heard of armoured catfish? (59.71% yes):

Interpretation: 59.71% of the respondents know or have heard of armoured catfish, indicating a significant level of prior knowledge about the species. However, the 40.29% who do not know about it shows that there is still a significant proportion of the population that needs more information about this resource.

- Have you ever tried armoured catfish (44.28% yes)?

Interpretation: 44.28% of the respondents have tried armoured catfish, suggesting that although it is known, its consumption is not yet common among the population. This may be due to factors such as negative perception or lack of promotion of its nutritional benefits.

- Have you consumed armoured catfish in the last three months? (28% yes):

Interpretation: Only 28% have consumed catfish in the last three months, indicating that its inclusion in the recent diet is low. This reinforces the idea that, despite knowledge about the fish, its acceptance as a regular food is still limited.

- How often do you consume armoured catfish (80% rarely)?

Interpretation: (80%) of the respondents consume the fish rarely, showing a very low frequency of consumption, which could be directly related to their negative perception, lack of habit or lack of knowledge on how to prepare it. This analysis shows that, although there is basic knowledge about catfish, its consumption remains low and sporadic, which underlines the importance of further efforts to promote its benefits and improve its acceptance in the population's diet.

Results on negative perception (independent variable)

The results obtained throughout this research allow us to identify the general perception of this species, which are presented below.

To demonstrate the variable 'Negative perception' of armoured catfish, the following questions were selected for analysis:

Box 3

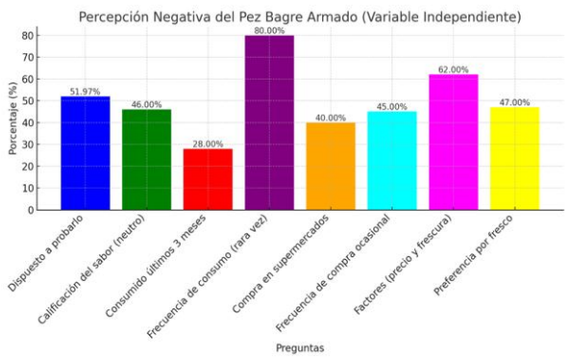

Figure 2

General interpretation of the independent variable: The results reflect that

- Willing to try the armoured catfish (51.97% yes):

Interpretation: 51.97 % of the respondents would be willing to try the fish, reflecting some interest. However, the rest of the population is still hesitant, possibly due to hesitation or lack of information.

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- Taste rating (46% neutral):

Interpretation: 46% of respondents rate the taste of the fish as 'neutral', indicating that they do not have a strong opinion for or against. This could be a point of neutrality to improve perception if the taste is properly promoted.

Consumed in the last three months (28% yes): Interpretation: 28% of respondents have consumed the fish recently, suggesting that it is not a frequent food choice, reinforcing the negative perception or lack of availability.

- Frequency of consumption (80% rarely):

Interpretation: 80% of respondents rarely consume the armoured catfish, reinforcing the negative perception and its limited inclusion in the local diet.

- Purchase (40%):

Interpretation: 40% indicate the most common channel of purchase in local markets or fishmongers.

- Occasional purchase frequency (45%):

Interpretation: 45% of the respondents buy catfish occasionally, which reflects that it is not a regular food in households and its consumption remains sporadic.

- Factors for purchase (62% mention price and freshness):

Interpretation: 62% of respondents indicate that price and freshness are the key factors for the purchase of armoured catfish, indicating that consumers mainly value these aspects when purchasing it.

- Preference for fresh (47%):

Interpretation: 47% of the respondents prefer to buy fresh catfish, suggesting that presentation and quality are important aspects in their purchasing decision.

The results show that, the negative perception of armoured catfish is very present, with a large proportion of the population not having tried it or having rated it negatively in terms of taste.

Although there is some interest in trying it, especially if it is offered in good freshness conditions, the low frequency of consumption and hesitancy of the respondents show that negative perception remains an obstacle to its adoption as a regular food resource. Taste and freshness are key factors in the purchasing decision, and improving these aspects, together with increased dissemination of its benefits, could help to change this negative perception in the long term.

Data visualization

As shown in Figure 1, 59.71% of respondents have heard of armoured catfish, indicating that more than half of the population is aware of this fish, although 40.29% are still unfamiliar with it. It is observed that only 44.28% of the respondents have consumed it, which shows that more of the population is familiar with it and a smaller percentage has consumed it.

Box 4

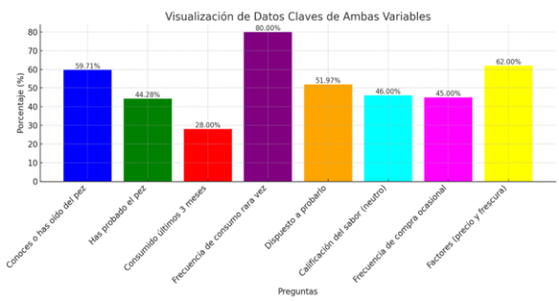

Figure 3

Source*: Own elaboration*

This graph shows that, although armoured catfish is well known, its consumption and acceptance still faces challenges, mainly due to taste perception and lack of frequency of consumption.

Conclusions

The development of this project has allowed us to clearly identify the challenges and opportunities related to the consumption of armoured catfish (*Hypostomus plecostomus*) in the fishing communities of the municipality of Centro, Tabasco. Throughout the research, it is confirmed that **knowledge** about the consumption of this species is one of the main factors that has contributed to its negative perception, which has limited its acceptance as a viable food resource. Results obtained: 1.

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Familiarity and limited consumption: Although 59.71% of respondents are aware of the existence of armoured catfish, only 44.28% have ever consumed it.

This gap between knowledge and consumption reflects a clear lack of information on the preparation methods and benefits of the fish, which inhibits its inclusion in the diet of local communities.

Potential for improvement: To improve the project on the consumption of armoured catfish, work is being done on projects that address issues such as: promotion strategies, marketing and creation of web pages on the consumption of this species.

Economic Benefits for Fishing Communities: The armoured catfish fishery not only offers a sustainable food alternative, but also opens up economic opportunities for fishing communities. Its commercialisation, still in its early stages in many areas, can generate additional income and diversify sources of local employment.

Promoting its consumption and sale can contribute to the economic development of these communities, while helping to mitigate the negative impacts of its presence as an invasive species.

Improved Marketing:

To maximise the economic potential of armoured catfish, improved marketing strategies are critical. This includes the development of efficient value chains, from capture and processing to distribution in local and regional markets.

Training of fishermen in processing and preservation techniques is recommended to increase the quality of the product and make it more competitive.

Strengthening partnerships

Successful marketing for consumption of armoured catfish also depends on strengthening strategic alliances between the different actors involved.

Through the work carried out by NODESS: Karina González Izquierdo, Roger Notario Priego, Diana Rubí Oropeza Tosca, María Rivera Rodríguez, Sepúlveda Quiroz Cesar Antonio and Manuel Vergel Escamilla of the NODESS Alim-Del-Sur (N2723000009), Edén-Del-Sur (N2723000010), Acuisur (N2723000018), Bagre-Del-Sur (N2723000011), Hermanos Del Sur (N2723000019) and Mecsur (N2723000013) who provide the facilities and the link with the fishing cooperatives associated with Fedecooptab (Federación de Cooperativas Pesqueras, Acuícolas y Permisionarios de Tabasco), providing the human capital to carry out the study, with the participation of the Cooperatives of: Pescadores De Boca Del Campo S.C. de R.L. de C.V., Barra Ciega S.C. de R.L. de C.V., Cooperativa Boca de Aztlán S.C. de R.L. de C.V., the Dirección de Emprendimiento y Desarrollo Empresarial de la Secretaría para el Desarrollo Económico y la Competitividad del Estado de Tabasco and the Universidad Juárez Autónoma de Tabasco (UJAT). They are key to knowledge and sustainable consumption.

These alliances can facilitate access to finance, training and technology, thus improving product competitiveness and benefiting communities as a whole.

Annexes

Category	Option	Percentage (%)
Age	20-24 years old	44.0
	25-34 years	29.0
	35-54 years	15.0
	55-60 years	7.0
	61 years and over	5.0
Sex	Men	53.0
	Women	47.0
Socio-economic status	Low medium ($8,499 a $16,787)	37.0
	Low (under $8,499)	35.0
	Medium-high ($16,788 a $34,622)	20.0
	High (over $34,623)	8.0
Knowledge of armoured catfish	Yes	59.71
	No	40.29
Willingness to try armoured catfish	Yes	51.97
	Indeciso	48.03

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Armed catfish test	Yes	44.28
	No	55.72
Taste rating of armoured catfish	Neutral	46.0
	Very bad	24.0
	Good	13.0
	Malo	10.0
	Very good	6.0
Consumption of armoured catfish in the last three months	No	72.0
	Yes	28.0
Frequency of consumption	Rarely	80.0
	Monthly	6.0
	Annually	5.0
	Fortnightly	4.0
	Weekly	4.0
Place of purchase	Supermarket	40.0
	Market	20.0
	Fish market	15.0
	Other	25.0
Frequency of purchase	Occasionally	45.0
	Monthly	25.0
	Weekly	20.0
	Daily	10.0
Factors considered when purchasing	Price	62.0
	Freshness	62.0
	Taste	61.0
	Availability	51.0
	Nutritional value	34.0
	Sustainability	31.0
	Other	46.0
Purchase presentation preference	Fresh	47.0
	Frozen	22.0
	Vacuum packed	14.0
	Other forms	17.0

Table 2 of results
Source (Own elaboration)

Authors' contribution

María Rivera Rodríguez: Contributing to the identification and classification of information sources - Problem statement, general objective: I contributed to the drafting of the general objective, for the knowledge and consumption of armoured catfish in the municipality of Centro, Tabasco, with a focus on sustainability and social economy, as well as the elaboration of the research instrument.

María del Carmen Hernández Martínez my contribution in this article was the elaboration of the instrument, application of the instrument, analysis of the instrument data, and elaboration of the methodology.

Karina González Izquierdo selected a representative sample of 2,458 participants through non-probabilistic convenience sampling. In order to ensure that the sample adequately reflects the socio-economic diversity of the municipality's population, which is crucial for the results to reflect the different perceptions of Armed Bagre fish.

During data collection, she applied surveys using digital tools such as Microsoft Forms. He also participated in the subsequent analysis of the data obtained to identify patterns and trends in consumption of armour catfish. She proposes practical recommendations to promote a positive change in the perception towards this species, thus contributing to environmental control and food diversification in the region.

María Patricia Torres Magaña, I contributed to the collective construction of knowledge, when an original article is published in a scientific journal, it contributes to the generation of knowledge. It contributes to the advancement of other researchers in the specific field of research.

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Article

Productivity improvements and sustainable management in the cooperative fishing society barra ciega of centro municipality, Tabasco

Mejoras en la productividad y gestión sostenible en la sociedad cooperativa pesquera barra ciega del Municipio del Centro, Tabasco

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Abstract

This article examines opportunities to improve the productivity and sustainability of the Cooperative Fishing Society Barra Ciega, located in Centro Municipality, Tabasco. The study focused on identifying the cooperative's current weaknesses, such as the lack of technological modernization and inefficient financial management. Through interviews with fishermen, historical data analysis, and the implementation of tools such as SWOT analysis and Ishikawa diagrams, the main areas of opportunity were evaluated. The results suggest that the introduction of advanced technologies for fishery management, along with the modernization of equipment, can significantly increase operational efficiency. Furthermore, training in financial management techniques is proposed as an essential tool to ensure the cooperative's economic sustainability. This research offers a series of practical strategies to enhance collaboration among cooperative members and optimize their performance, thereby contributing to the sustainable development of the local community.

Objectives	Methodology	Contribution
- Improve the productivity and sustainability of the cooperative.	- Interviews with fishermen.	- Practical strategies for cohesion and collaboration among members.
- Identify weaknesses such as lack of technology and financial management.	- SWOT and Ishikawa analysis to identify opportunity areas.	- Proposals for implementing advanced technology.
Propose training in financial management to ensure economic sustainability.	- Analysis of historical productivity data.	- Contribution to the sustainable development of the local community.

Implementation, Sustainability, Collaboration

Resumen

Para mejorar la productividad y la sostenibilidad el estudio se enfocó en identificar las debilidades actuales de la cooperativa, como la falta de modernización tecnológica y la ineficiente gestión financiera. A través de entrevistas a los pescadores, análisis de datos históricos y la implementación de herramientas como el análisis FODA y el diagrama de Ishikawa, se evaluaron las principales áreas de oportunidad. Los resultados sugieren que la introducción de tecnologías avanzadas para la gestión de la pesca, junto con la modernización de equipos, puede incrementar significativamente la eficiencia operativa. Asimismo, se propone la capacitación en técnicas de gestión financiera como una herramienta esencial para asegurar la sostenibilidad económica de la cooperativa. Esta investigación ofrece una serie de estrategias prácticas para mejorar la cohesión entre los miembros de la cooperativa y optimizar su rendimiento, contribuyendo de esta manera al desarrollo sostenible de la comunidad local.

Objetivos	Metodología	Contribución
- Mejorar la productividad y sostenibilidad de la cooperativa.	- Entrevistas con pescadores.	- Estrategias prácticas para la cohesión y colaboración entre miembros.
- - Identificar debilidades como la falta de tecnología y gestión financiera.	- Análisis FODA e Ishikawa para detectar áreas de oportunidad.	- Propuestas para la implementación de tecnología avanzada.
- Proponer capacitación en gestión financiera para asegurar la sostenibilidad económica.	- Análisis de datos históricos de productividad.	- Contribución al desarrollo sostenible de la comunidad local.

Implementación, Sostenibilidad, Colaboración

Citation: Vidal-Reyes, Laura, Javier-Geronimo, Zinath, Reyes-Osorio, Yaitla Aitza and Rivera-Rodriguez, María. [2024]. Productivity improvements and sustainable management in the cooperative fishing society barra ciega of centro municipality, Tabasco. Journal-Microeconomics. 8[14]-1-9: e60814109.

Introduction

The Sociedad Cooperativa Pesquera Barra Ciega, located in the municipality of Centro, Tabasco, plays a key role in the local economy and according to data from the NODESS directory (Instituto Nacional de Economía Social [INAES], n.d.), the sector faces challenges related to lack of technological modernisation, high operating costs and poor financial management, as indicated by Cisneros, (2022). These problems limit their productivity and sustainability, affecting the economic well-being of their members and the community.

This study proposes innovative solutions to strengthen the cooperative's operations through technological modernisation, the implementation of advanced tools and training in financial management. It is proposed that these measures will increase productivity and ensure economic sustainability.

The problem to be solved is low operational performance and limited sustainability due to lack of modern resources and management skills. The central hypothesis is that the incorporation of advanced technology and financial literacy training will increase productivity and improve the sustainability of the cooperative.

The sections of this article are organised as follows:

1. Current Situation: An overview of the cooperative's specific challenges.

2. Methodology: The tools and methods used to identify and analyse areas for improvement.

3. Results: The key findings and their implications for the cooperative's development.

4. Conclusions: Final recommendations for the implementation of the proposed strategies.

Current Situation

The Sociedad Cooperativa Pesquera Barra Ciega, located in the municipality of Centro, Tabasco, plays a fundamental role in the fishing economy of the region, providing work and livelihoods for many local families. Following the principles of the International Cooperative Alliance (ICA, 2024), the Sociedad Cooperativa Pesquera Barra Ciega stands out for its social cohesion and commitment among members, which constitutes a solid basis for implementing sustainable strategies and strengthening internal collaboration. However, this cooperative faces important challenges that limit its growth and put its long-term sustainability at risk. According to FAO (2024), the guidelines for sustainable fisheries stress the importance of adopting responsible practices that enable local fishing communities, such as the Sociedad Cooperativa Pesquera Barra Ciega, to balance productivity and long-term sustainability. Among the most critical problems is the lack of technological modernisation, a situation that leads to a large part of their operations being carried out using traditional methods, with records and production control still handled manually. This not only reduces the accuracy and efficiency of their activities, but also impedes the implementation of effective strategic planning and makes it difficult to make informed data-driven decisions.

Despite high operating costs, the cooperative has demonstrated resilience by implementing cost-saving measures, such as fuel optimisation strategies. Fuel, for example, is one of the major expenditures in the operating budget and directly affects the profitability of fishing activities. The vessels, mostly old and worn out, require constant maintenance, which further increases costs. This situation limits the cooperative's ability to reinvest in better equipment and modernise its operations, closing the door to opportunities for expansion and growth.

In addition, the cooperative faces difficulties in managing its financial resources. The absence of a formal accounting system and staff trained in financial management contributes to inefficient use of income, and the lack of a documented financial history complicates access to credit or external financing.

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These resources could be used to modernise infrastructure and train members, but the lack of an adequate financial structure limits this possibility. Strengthening indigenous cooperatives (National Institute of Indigenous Peoples, 2024) is crucial for economic development in vulnerable communities.

Despite these challenges, one of the strongest aspects of the cooperative is the social cohesion and collaboration among its members. There is a strong sense of commitment and solidarity that has allowed the cooperative to survive in difficult times, which is an advantage that could facilitate the implementation of structural improvements. However, it is essential to encourage active participation and continuous training that allows members not only to adopt new technologies, but also to improve their skills in administrative management, so that they can face current and future challenges more effectively. It is therefore suggested to address the Sustainable Fisheries Plan Programme in consultation with IMIPAS (Government of Mexico, 2024) that establishes priorities to promote economic sustainability in the region.

Methodology

The methodology used combined participatory tools and diagnostic techniques to understand the current problems of the Sociedad Cooperativa Pesquera Barra Ciega. Semi-structured interviews were conducted with the fishermen to collect data on daily operations and challenges faced, which allowed for the identification of recurring themes, such as lack of technology and deficiencies in financial management.

These interviews were key to identifying recurring themes and understanding the operational and financial constraints affecting the cooperative from the point of view of those directly involved in the activities.

Complementing the interviews, an analysis of historical data on the cooperative's fishing production was carried out, covering aspects such as catch volume, operating costs, and variations in performance over time.

This review allowed trends and patterns in productivity to be observed, as well as providing a basis for assessing the impact of external factors such as changes in climatic conditions and fluctuations in market prices, as Yu et al. (2024) have pointed out, changes in natural resource management can be critical to ensure sustainable development in vulnerable sectors. The combination of quantitative and qualitative data was crucial to obtain a balanced view of the current situation.

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Box1

Variables Analysed

- Catch Volume
- Operational Costs
- Productivity
- Financial Management

Figure 1

Variables analysed

Source: *Interviews conducted*

To structure and deepen the analysis, a SWOT analysis was used, a tool to classify the cooperative's strengths, weaknesses, opportunities and threats, Adesina et al. (2024).

This analysis not only helped to identify internal resources that can be leveraged and obstacles that need to be overcome, but also to examine how external factors, such as lack of access to finance and changes in market demand, impact on the overall performance of the cooperative. In addition, an Ishikawa diagram was applied to decompose and visualise the root causes of the problems of low productivity and high operating costs.

This tool facilitated the identification of complex causal relationships and provided a clear structure for examining how the lack of appropriate technology, high fuel costs and poor financial management interact with each other, affecting the cooperative's operations and sustainability.

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Box 2

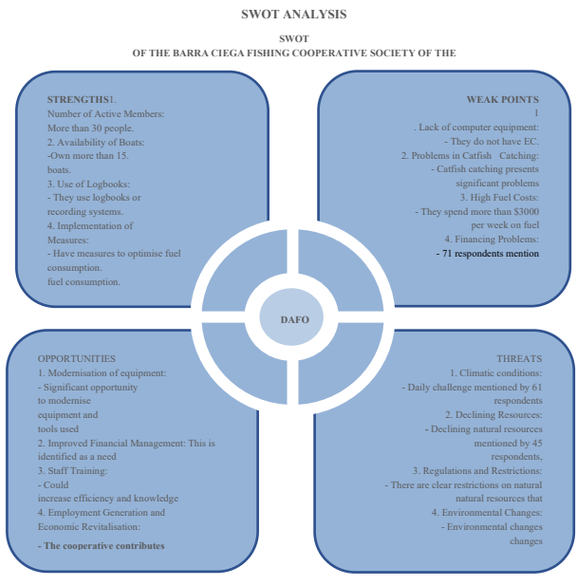

Figure 2
SWOT Analysis
Source: *Vidal-Reyes, 2024*

Overall, this methodology allowed not only to assess the current situation of the cooperative, but also to propose practical solutions based on a comprehensive understanding of its challenges and opportunities. The integration of qualitative and quantitative techniques provided a solid and multidimensional perspective, which strengthens the proposed recommendations in terms of their feasibility and effectiveness in improving the cooperative's situation.

Results

The results of this study revealed critical areas for improvement, especially in productivity, operating costs and financial management. Lack of technological modernisation and reliance on manual methods negatively affect operational performance. In addition, high fuel costs and maintenance of obsolete vessels limit the profitability of fishing activities. In terms of operational costs, fuel expenditure was identified as one of the main economic burdens for cooperative members. This high cost, coupled with the constant need for boat maintenance, affects the profitability of fishing activities. Many of the fishermen pointed out that their vessels are obsolete and that preventive and corrective maintenance has become a recurrent economic burden.

This problem not only reduces the fishermen's net income, but also limits the possibility of reinvestment in more efficient and sustainable equipment.

The assessment of the cooperative's financial management yielded another set of important findings. Currently, the cooperative lacks a formal accounting system and a structured plan for managing its income and expenditures. This lack of organisation in the management of financial resources translates into a significant dependence on inconsistent income and limited savings capacity. In addition, the lack of a documented financial history makes it difficult to access external funding or support that could be used to modernise equipment and optimise the cooperative's operations. This represents a major barrier to the sustainable development of their activities and to the strengthening of their productive capacity in the long term.

These results provide a solid basis for the recommendations proposed in this study. The combination of technological modernisation, cost optimisation and strengthening of financial management are key elements that could transform the functioning of the cooperative and ensure its viability in a competitive and constantly changing environment. The implementation of these improvements would not only benefit the members of the cooperative, but also the local economy at large. Raji et al. (2024) highlight how the integration of technology and market strategies can improve productivity in economic sectors such as agriculture, which is also applicable to the fisheries sector.

Box 3

Variable	Result
Catch and Productivity	89 members report catches in excess of 1500 kg weekly.
Catfish Harvesting Problems	Catching catfish presents difficulties, affecting the efficiency of the cooperative.
Fuel Costs	93 members spend more than $3000 per week on fuel.
Fuel Optimisation	104 members have implemented fuel saving strategies.
Catch Recording	104 members use logbooks or systems to document catches.

Table 1
Main Results
Source: Vidal-Reyes 2024

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Box 4

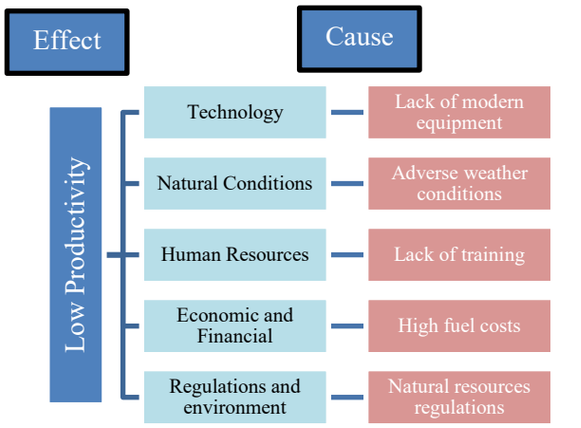

Figure 3
Cause effect
Source: *Vidal-Reyes, 2024*

Conclusions

This study confirms that the Sociedad Cooperativa Pesquera Barra Ciega faces significant challenges that limit its productivity and long-term sustainability. Among the most relevant problems are the lack of technological modernisation, high operating costs and deficiencies in financial management.

Through a comprehensive analysis, including the use of tools such as the Ishikawa diagram and SWOT analysis, key areas were identified in which the cooperative can intervene to improve its performance and viability.

The incorporation of advanced technology emerges as one of the most urgent and effective solutions. The implementation of digital recording systems and technological tools for production management would enable the cooperative not only to improve its operational efficiency, but also to obtain more accurate data for strategic decision-making. This change would reduce reliance on manual methods and optimise control over catches and costs, facilitating more accurate and productive management.

In terms of operational costs, in addition to modernising vessels and providing training in financial management, it is recommended that social cohesion among members be fostered, which will be essential for long-term sustainability.

These changes would not only reduce fuel costs, which represent one of the main financial burdens for cooperative members, but would also contribute to improving the profitability and sustainability of fishing activities. Optimising these resources would allow cooperative members to increase their profit margins and reinvest in better equipment and training.

Financial management is another critical aspect that needs to be strengthened to ensure the sustainability of the cooperative. The creation of a formal accounting system and training in resource management would help members manage their income and expenses more effectively. In addition, a well-documented financial history would increase the likelihood of accessing external funding and other support that could be used to expand the cooperative's capacities and improve infrastructure.

Finally, social cohesion and commitment among members are essential factors for the implementation of these improvements. Encouraging active participation and continuous training would help cooperative members to adopt new technologies and management practices more effectively. This sense of collaboration also facilitates resilience to future challenges and strengthens the role of the cooperative in local economic development.

In conclusion, the combination of these strategies could significantly transform the sustainability of the cooperative, securing its future in a competitive environment. Strategic design is essential to ensure that organisations achieve sustainable productivity, as indicated by Sari and Nugraha (2024). In the case of the fishing cooperative, this involves the implementation of advanced technologies and continuous training, which would maximise operational performance and ensure long-term sustainability. These recommendations will not only benefit the cooperative in terms of economic performance, but also strengthen its impact on the local economy, ensuring its viability in an increasingly competitive and changing environment. Liu et al. (2024) found that sustainable techniques such as organic fertilisation and no-tillage can have a significant impact on productivity, reflecting the potential of the strategies proposed in this study.

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Annexes

Questionnaire applied to Sociedad Cooperativa Pesquera Barra Ciega

This questionnaire was designed to collect key information on the practices, challenges and needs of the Sociedad Cooperativa Pesquera Barra Ciega. Its main purpose is to identify areas for improvement and opportunities for development that can strengthen the co-operative's operations. The data obtained will serve as the basis for the recommendations and proposals included in this project.

1. How many people currently make up the cooperative and how many of them are directly involved in the fishing activity?

Mark only one oval.
Less than 10
From 10 to 20
20 to 30
More than 30

2. How many boats does the cooperative own for fishing activities?

Mark only one oval.
Less than 5
From 5 to 10
From 10 to 15
More than 15

3. Does the cooperative have computer equipment or other technological devices for record-keeping or analysis related to fishing?

Mark only one oval.
Yes, it has computer equipment
Yes, it has other technological devices
No, it does not have computer equipment or technological devices
Not sure

4. Do you keep detailed records of fishing boat trips?

Mark only one oval.
Yes, they keep detailed records
No, they do not keep detailed records

5. Do you use logbooks or any recording system to document the amount of fish caught on each fishing trip?

Mark only one oval.
Yes, do they use logbooks or other recording system?
No, they do not use a logbook or recording system.

6. What is the average number of kilograms of fish you manage to catch per week as a cooperative?

Mark only one oval.
Less than 500 kg
From 500 kg to 1000 kg
From 1000 kg to 1500 kg
More than 1500 kg

7. Have you faced any problems related to catfish catching in the area where you operate?

Mark only one oval.
Yes, have you faced problems with catfish catching?
No, they have not faced any problems with catfish catching.

8. What impact does this problem have on the productivity and profitability of the cooperative?

Mark only one oval.
Low impact
Moderate impact
High impact
Not sure

9. What are the costs associated with the purchase of gasoline for vessels used in fishing?

Check one oval only.
Less than $1000 per week
From $1000 to $2000 per week
From $2000 to $3000 per week
More than $3000 per week

10. How have you managed these costs and looked for ways to optimise fuel consumption?

Check only one oval.
Implementing optimisation measures
Have not implemented optimisation measures

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11. How long have you been involved in fishing within the cooperative?

Mark only one oval.
Less than 1 year
1 to 5 years
5 to 10 years
More than 10 years

12. What is your function or role within the cooperative?

Mark only one oval.
Fisherman
Fish processing
Marketing
Other:

13. What fishing techniques or methods do you usually use?

Mark only one oval.
Trawls
Hook and line fishing
Traps or pots
Other:

14. What kind of equipment and tools are necessary to carry out your fishing activity?

Mark only one oval.
Nets
Hooks and lines
Boats
Other:

15. Have you noticed any changes in fishing methods in recent years? What changes have you observed?

Mark only one oval.
Yes, significant changes
Yes, minor changes
No, I have not noticed any changes

16. What natural resources do you use for fishing in this area?

Mark only one oval.
Fish
Crustaceans
Molluscs
Other:

17. How would you describe the quality and quantity of the resources available in the fishing area?

Mark only one oval.
Good quality and quantity
Acceptable quality, but limited
limited
Poor quality and quantity

18. Are there any restrictions or regulations on the natural resources that can be used for fishing?

Mark only one oval.
Yes, clear restrictions
Some restrictions
No restrictions

19. What are the main challenges you face in your daily fishing activity?

Mark only one oval.
Climatic conditions
Decreasing resources
Competition with other cooperatives
Other:

20. What factors do you consider limit productivity in the cooperative?

Tick only one oval.
Lack of modern equipment
Financing problems
Shortage of skilled labour.
Other:

21. Have you experienced changes in the environment that have affected fishing in the area?

Mark only one oval.
Yes, significant changes
Yes, minor changes
No, I have not experienced any changes

22. How would you describe the dynamics and the relationship between the members of the cooperative?

Tick only one oval.
Collaborative and supportive
Competitive
Dysfunctional

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23. What actions are carried out to

promote collaboration and solidarity among the members of the cooperative?
Tick only one oval.
Regular meetings
Team trainings
Incentive programmes
Other:

24. From your point of view, what aspects could be improved to increase productivity and well-being within the cooperative?

Tick only one oval.
Modernisation of equipment
Improvement of financial management
Staff training
Other:

25. How do you think the cooperative contributes to the socio-economic development of the local community?

Tick only one oval.
Employment generation
Economic dynamisation
Improvement in the quality of life of the inhabitants

Box5

No.	Question	Most frequent response	Porcentage
1	How many people are currently members of the cooperative and how many of them are directly involved in the fishing activity?	more than 30	91
2	How many boats does the cooperative own to carry out fishing activities?	more than 15	91
3	Does the cooperative have computer equipment or other technological devices for record keeping or analysis related to fishing?	No, they do not have equipment	64
4	Do they keep detailed records of fishing boat trips?	Si	50
5	Do you use logbooks or any recording system to document the amount of fish caught on each trip?	si	91
6	What is the average number of kilograms of	Over 1500 kg	73
7	of fish that you manage to catch each week as a cooperative?	Yes	91
8	Have you faced any problems related to the catfish catch in the area where you operate?	High impact	64
9	What impact does this have on the productivity and profitability of the cooperative?	More than 3000 per week	82
10	What are the costs associated with the purchase of gasoline for the boats used in the fishery?	Implement optimisation measures	95
11	How have you managed these costs and sought ways to optimise fuel consumption?	more than 10 years	63
12	How long have you been involved in fishing within the cooperative?	fisherman	67
13	What is your function or role within the cooperative?	traps or pots	87
14	What fishing techniques or methods do you usually use?	boats and hooks	47
15	What kind of equipment and tools are necessary to carry out your activity?	yes	91
16	Have you noticed any changes in fishing methods over the last few years? What changes have you observed?	fish	96
17	What natural resources do you use for fishing in this area?	acceptable quality	63
18	How would you describe the quality and quantity of the resources available in the fishing area?	clear restrictions	86
19	Are there any restrictions or regulations on the natural resources that can be used for fishing?	climatic conditions and diminishing resources	87
20	What are the main challenges?	funding problems	65
21	What factors do you consider limit productivity in the cooperative?	yes	94
22	Have you experienced changes in the environment that have affected fishing in the area?	collaborative and supportive	96
23	How would you describe the dynamics and relationship between the members of the cooperative?	regular meetings	76
24	What actions are taken to	modernisation of equipment	40
25	From your point of view, what aspects could be improved to increase productivity and well-being within the cooperative?	employment generation	64

Table 2
Survey summary results
Source: Vidal-Reyes 2024

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' contributions

Vidal-Reyes, Laura: Contributed the project idea and research development.

Javier Geronimo, Zinath: Contributed research development and data analysis.

Reyes-Osorio, Yaitla Aitzac: Contributor to the revision and editing of the manuscript.

Rivera Rodríguez, María: Contributed to the research method and data analysis.

Availability of data and materials

Data sets used or analysed during this study are available from the corresponding author upon reasonable request.

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Abbreviations

FODA	Strengths, Opportunities, Weaknesses and Threats
PIB	Gross Domestic Product
IMIPAS	Mexican Institute for Research on Sustainable Fisheries and Aquaculture (Instituto Mexicano de Investigación de Pesca y Acuacultura Sustentables)
NODESS	Nodes for the Promotion of the Social and Solidarity Economy
INAES	National Institute of Social Economy

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Support

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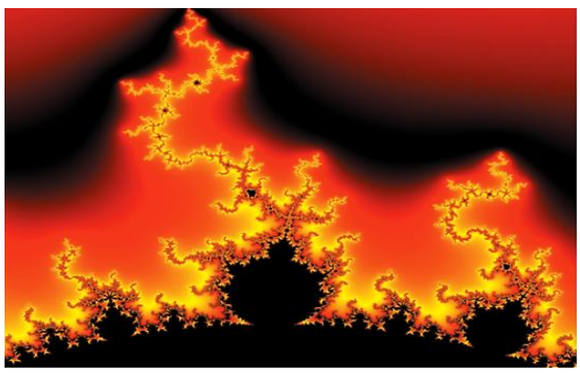

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Methodology

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

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The results shall be by section of the article.

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Clearly explain the results and possibilities of improvement.

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Tables and adequate sources.

The international standard is 7 pages minimum and 14 pages maximum.

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

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Benoit-Pauleter, Gerard: Contributed to the project idea, research method and technique.

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Indicate the availability of the data obtained in this research.

Funding

Indicate if the research received some financing.

Acknowledgements

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

Abbreviations

List abbreviations in alphabetical order.

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ANN	Artificial Neural Network

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