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In the first article present *Analysis of Problems in the Work Areas of Micro and Small Businesses in Santa Cruz Rosales, Chihuahua* by Valles-Alarcón, Isela Adriana, Palafox-Bolivar, Marisol Priscila, Molina-Lara, Elia Angélica and Mata-Carrasco, Hermila, with adscription at Universidad Autónoma de Chihuahua, as the next article we present *Supply chain performance analysis using SCOR and digital marketing: a case study in the technology sector* by Bárcenas-Nava, Ma. de los Angeles, Trujillo-Beltran, Elisa, Ramírez-Mendoza, Maximiliano and Kido-Miranda, Juan Carlos, with adscription at Instituto Tecnológico de Iguala, as the next article we present *Organizational agility in the Tourism Sector: Effects of corporate culture on the agile experience* by Hinojosa-Rodríguez, Carlos Jesús, De la Mora-Yocupicio, Moncayo-Rodríguez, Lizette Marcela and Quiroz-Campas, Celia Yaneth, with adscription at Instituto Tecnológico de Sonora, as the next article we present *The Community High School student as an agent of environmental change. Tres Mariás Morelos* by Silveyra-Rosales, Mariana Teresa, Sandoval-Manrique, Juan Carlos and Machorro-Onofre, Ana Rosa, with adscription at Universidad Autónoma del Estado de Morelos, as the next article we present *Prototype of a web application for the promotion of tourism in the Huasteca Hidalguense* by Salazar-Casanova, Hermes, Mendoza-San Juan, Luis Alberto, Meneses-Flores, Arturo Élfego and González-González, Fabiola, with adscription at Universidad Tecnológica de la Huasteca Hidalguense, as the next article we present *Competitive strategies of micro-entrepreneurs in southern Tamaulipas after the Covid-19 pandemic* by Soto-Hernández, Ana María, Alonso-Olivares, Saúl Emmanuel and De la Garza-Saldívar, Sandra, with adscription at Instituto Tecnológico de Ciudad Madero and Universidad Autónoma de Tamaulipas, as the last article we present *Implementation of a digital intermediation model as a competitive advantage of a personalized service in a hostess travel agency* by Delgado-Torres, Claudia Lizethe, Ríos-Castillo, Maricela, Villarreal-Benavides, Clara Maria and Madrigal-Enríquez, Jessica Berenice, with adscription at Tecnológico de Nuevo León.

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Analysis of Problems in the Work Areas of Micro and Small Businesses in Santa Cruz Rosales, Chihuahua




Análisis de problemas en las áreas de trabajo de micro y pequeños negocios en Santa Cruz Rosales, Chihuahua

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








Abstract











In the state of Chihuahua, micro and small businesses are essential for the local economy. The objective of this research was to analyze their structure and functioning, identifying problems in work areas to propose improvements that optimize performance. The applied methodology had a mixed approach, applied, non-experimental, cross-sectional, and documentary, with a deductive method. Surveys were used as the main technique, applied in the municipality of Santa Cruz Rosales through an 18-question questionnaire designed in Google Forms, complemented with field observations. The results revealed deficiencies in inventory control, management of income and expenses, and poorly structured organizational charts. It is concluded that micro and small businesses lack sufficient information and adequate tools to improve their processes, limiting their quality and competitiveness. Entrepreneurs agreed on the need to implement administrative and technological processes to strengthen their businesses and improve their sustainability in the regional market.

Resumen

En el estado de Chihuahua, los micro y pequeños negocios son esenciales para la economía local. El objetivo de esta investigación fue analizar su estructura y funcionamiento, identificando problemas en las áreas de trabajo para proponer mejoras que optimicen su desempeño. La metodología aplicada fue de enfoque mixto, de tipo aplicada, no experimental, transversal y documental, con un método deductivo. Se utilizaron encuestas como técnica principal, aplicadas en el municipio de Santa Cruz Rosales a través de un cuestionario de 18 preguntas elaborado en Google Forms, complementado con observaciones de campo. Los resultados evidenciaron deficiencias en el control de inventarios, en la gestión de ingresos y egresos, así como organigramas poco funcionales. Se concluye que los micro y pequeños negocios carecen de información y herramientas adecuadas para mejorar sus procesos, lo que limita su calidad y competitividad. Los empresarios coincidieron en la necesidad de implementar procesos administrativos y tecnológicos para fortalecer sus negocios.

Analysis of Problems in the Work Areas of Micro and Small Businesses in Santa Cruz Rosales, Chihuahua		
Objectives	Methodology	Contribution
 Analyze the structure and functioning.	 Mixed approach: Applied, Non-experimental, Cross-sectional.	 Evidence of administrative weaknesses.
 Identify main problems in inventory, revenues, expenses, and organizational charts.	 Documentary research and fieldwork.	 Need for training and tech tools.
 Propose improvements to optimize performance.	 Surveys (18-20 items) applied to 30 businesses.  Google Forms analysis.	 Recommendations to strengthen competitiveness and sustainability.

Inventory control, and microbusinesses, organizational charts

Análisis de problemas en las áreas de trabajo de micro y pequeños negocios en Santa Cruz Rosales, Chihuahua		
Objetivos	Metodología	Contribución
 Analizar la estructura y funcionamiento de los micro y pequeños negocios.	 Enfoque mixto (aplicado, no experimental, transversal).	 Evidencia de debilidades en los procesos de gestión.
 Identificar los principales problemas en inventarios, ingresos, egresos y organigramas.	 Investigación documental y trabajo de campo.	 Necesidad de capacitación y uso de herramientas tecnológicas.
 Proponer mejoras para optimizar el desempeño.	 Encuestas (18-20 ítems) a 30 negocios.  Análisis en Google Forms.	 Recomendaciones para fortalecer la competitividad y sostenibilidad.

Control de inventarios, y micro negocios, organigramas

Area: Promotion of frontier research and basic science in all fields of knowledge

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1. Introduction

Micro and small businesses are a fundamental pillar of the local and regional economy, especially in municipalities such as Santa Cruz Rosales, Chihuahua. Their importance lies in the generation of jobs, the revitalisation of the domestic market, and the possibility of offering products and services tailored to the needs of the population. However, despite their relevance, many of these businesses have deficiencies in their administrative and management processes that limit their competitiveness.

The added value of this study compared to other approaches lies in its comprehensive analysis of key areas such as inventory control, income and expenditure, and organisational structure, elements that are often overlooked in research focused on micro-enterprises. By focusing specifically on these areas, the research provides a clear picture of the difficulties faced by entrepreneurs and the possible solutions applicable in similar contexts.

The problem to be solved is the lack of formal processes and management tools in micro and small businesses, which leads to low efficiency and sustainability. The central hypothesis is that the implementation of basic administrative processes and the use of technological tools contribute significantly to improving the performance of these economic units. The article is organised into several sections. First, the theoretical framework and research background are presented. Next, the methodology used is described, with details of the instruments and techniques applied. The third section presents the results of the analysis, highlighting the main problems identified. Finally, the conclusions are discussed and recommendations are made to strengthen the competitiveness and sustainability of micro and small businesses in the region.

2. Theoretical framework

2.1. Background of micro and small businesses in Mexico

MSMEs in Mexico need to strengthen their competitiveness in order to remain in the market. Many of them focus solely on reducing costs, sacrificing quality, without addressing key aspects such as operational efficiency, sales growth and profitability.

Given their relevance to the economy and the challenges they face, we propose to analyse their business permanence in order to propose actions that improve their environment, promote their growth and consolidate their competitiveness.

Among the main obstacles are limited access to financing, low profitability, and poor integration into value chains. Although public policies have led to progress, financial support remains insufficient. It is therefore essential to redesign the Mexican government's support policies to focus them on sustainable development and the strengthening of MSMEs (Romero, 2020).

2.2. Microbusinesses in Mexico

Mexico is distinguished by the creativity and improvisational skills of its citizens, who constantly generate quick solutions and seek alternative employment. With an unemployment rate of nearly 5% of the economically active population, many Mexicans find microenterprise to be an option for subsistence and economic development.

The relevance of microbusinesses is remarkable: according to INEGI (2020), they contribute around 52% to the national GDP. This phenomenon, however, is not always the result of a strategic decision, as in many cases it arises as a temporary alternative in the absence of job opportunities or because of the convenience of starting a small-scale business (Avilés, 2021).

Given the global economic situation and the reduction in hiring by large companies, microbusinesses in Mexico continue to be a pillar of economic sustainability, although they face structural challenges that condition their permanence and growth.

2.3. Competitive strategies in food processing micro-businesses in a marginalised locality

Self-employment in marginalised areas is emerging as an alternative to improve living conditions, driving the creation of micro-businesses dedicated to food processing. These economic units, which were previously linked to informal trade, are now recognised as relevant actors in job creation and local economic development.

However, their contribution is limited due to structural problems such as low productivity, lack of financing, poor management skills and a lack of strategic vision.

Although micro-businesses provide socio-economic benefits, they face difficulties in competing in markets dominated by large companies and conditioned by economic policies that do not promote equitable growth. In this context, the implementation of competitive strategies becomes essential, as most microentrepreneurs prioritise personal subsistence over business growth. It is concluded that strengthening strategic planning and administrative capacities is key to increasing the competitiveness and sustainability of these microenterprises (Benítez, 2019).

2.4. An integrated agenda to promote productivity and formalisation

MSMEs are key players in job creation in Latin America and the Caribbean; however, they have low levels of productivity and high rates of informality. This sector is heterogeneous: it ranges from subsistence units to dynamic and innovative companies with participation in international markets. However, those with low productivity predominate, which limits their contribution to economic growth.

The region maintains a model of productive specialisation focused on primary goods, with little diversification, low technological content and weak linkages. Factors such as limited financing, competition from the informal sector, inflexible tax systems and a poorly trained workforce exacerbate the problem.

Informality is concentrated in low-productivity enterprises, confirming that this is the main cause of job insecurity. Overcoming this situation requires an integrated agenda that promotes productivity, formalisation and better working conditions, supported by effective institutional and labour policies (Ferraro, 2020).

2.5. Operational efficiency: necessary but not sufficient

Operational efficiency and strategy are essential elements for achieving superior performance in companies, although they operate differently.

Competitive advantage is only sustainable when the organisation manages to differentiate itself in a way that generates greater value for the customer or similar value at a lower cost. This allows for higher prices per unit to be set by delivering better service or reducing unit costs through greater efficiency.

Differences in costs or prices between companies originate in the multiple activities that make up the value chain: production, sales, customer service and employee training. Performing these activities more efficiently than competitors provides cost advantages, while the strategic choice of which activities to perform contributes to differentiation. In this sense, operational efficiency consists of performing the same tasks better than the competition; however, it does not in itself ensure sustainability, as it must be complemented by a clear strategy (Porter, 2008).

2.6. Business, management and administrative process

A business is an organisation created by one or more people for the purpose of carrying out economic activities that generate goods and services to meet social needs and, at the same time, obtain profits that ensure its continued existence. Its importance lies in the fact that, in addition to producing economic value, it is a fundamental axis of social development and employment.

Businesses can be classified by economic sector: primary (agriculture and livestock), secondary (industry), tertiary (services) and quaternary (technology and knowledge). According to their size, they can be classified as micro, small, medium and large enterprises, depending mainly on the number of employees and the volume of operations. Likewise, according to their legal form, they can be structured as cooperatives, public limited companies, limited liability companies or sole proprietorships.

In this context, the administrative process becomes the key tool for planning, organising, directing and controlling the company's resources, in order to ensure competitiveness and sustainability (Vélez, 2018).

3. Conceptual Framework

3.1. International Accounting Standard 2 (IAS 2)

This standard establishes the criteria for the presentation and valuation of inventories in financial statements, which is essential for companies that manage this type of asset. Its correct application ensures a true and fair view of the economic situation by defining how costs should be recognised and subsequently recorded as an expense in the income statement.

In Mexico, Financial Reporting Standard C-4 'Inventories,' issued by the CINIF, complements these guidelines by setting clear rules for accounting treatment, cost calculation, and timely recognition. In addition, it requires periodic reviews and provisions to prevent losses due to obsolescence or deterioration.

Compliance with these international and national standards is essential to ensure transparency and reliability in financial reporting, promoting the comparability of financial statements and strengthening business decision-making (Borges, 2024).

3.2. Commercial Area

The commercial area is fundamental for any company, regardless of its line of business or size, as it involves identifying and understanding customers, as well as using promotional strategies aimed at capturing their attention. Organisations must develop actions that increase the attractiveness of their products or services, while conducting a comparative analysis of the competition to recognise strengths and weaknesses and generate competitive advantages that allow them to position themselves in the market.

3.3. Raw Materials

Raw materials are natural resources that are essential for the production of food, energy and textiles, making them a pillar of the economy. They are typically characterised by mass production and standardised quality and quantity, which facilitates their commercialisation at uniform prices. In stock markets, these inputs are traded similarly to shares, highlighting their strategic importance in global trade.

3.4. Human Resources

Human resources are essential to business management, as they involve planning functions, selection processes, hiring, remuneration and staff motivation. They also encompass the creation of a safe working environment, compliance with administrative and legal responsibilities, internal communication and continuous training, all of which contribute to organisational development and productivity.

Marketing and Sales

The marketing area focuses on designing strategies for specific market segments, including product planning, product life cycle, and the marketing mix (product, price, communication, and distribution). Its main purpose is to achieve organisational objectives through effective communication and customer acquisition.

3.6. Management

The management area is the central axis of the organisation, as it is responsible for establishing strategic objectives, making important decisions and coordinating the overall functioning of the company. Its role involves supervising and coordinating all operational areas, ensuring that activities are carried out in a coherent and efficient manner to fulfil the organisational mission.

3.7. Investment, Financing and Administrative Area

Every company, regardless of its size, needs to manage income and expenses, make investments, seek financing, issue invoices, keep accounts and comply with tax obligations. These functions, which are fundamental to organisational sustainability, are concentrated in the administrative area and must be strategically coordinated by management.

3.8. Administrative Accounting

Administrative accounting is an information system geared towards internal management needs, whose purpose is to support planning, control and decision-making.

Its applications include budgeting, calculating production costs and evaluating organisational and managerial performance, making it a key tool for managers and area leaders.

3.9. Diagnosis

Organisational diagnosis is an analysis process that provides insight into the current situation of the company, identifies problems and designs interventions for change. Its periodic application facilitates the detection of deficiencies in administrative, financial, productive or commercial areas, with the aim of correcting them and improving profitability. To this end, tools such as the SWOT matrix, problem and objective trees, and financial statement analysis are used, which strengthen internal control and strategic decision-making.

3.10. Production

The production area is responsible for transforming raw materials into finished goods and services, ensuring the efficient use of resources and compliance with quality standards. Its management involves the appropriate selection of materials, quantities and suppliers, in order to optimise processes and guarantee results that meet market demands (Talancón, 2006).

3.11. SWOT Analysis

SWOT analysis is a strategic tool that allows the internal situation of an organisation to be evaluated by identifying its strengths and weaknesses, as well as its external context through opportunities and threats. Its application offers a comprehensive and simple view of the company's strategic position.

4. Methodology

4.1. Research Approach

The approach of this research was mixed because an 18-question questionnaire was used to obtain the information.

4.2. Research method

Applied, as the results obtained are intended to provide alternative solutions to the problems identified here.

4.3. Type of research

The type of research was non-experimental, non-experimental exploratory cross-sectional because the study variables were not manipulated, i.e. it investigated existing facts, cross-sectional because it was carried out over a specific period of time, and exploratory because the subject matter is relatively new.

4.4. Research method

The mode was documentary, because information sources such as books, magazines and websites were used to support this research, and fieldwork, because questionnaires were administered and supplemented with the use of social networks.

4.5. Method

The method was deductive, because the research flowed from the general to the specific.

4.6. Research techniques

The techniques used were surveys with observation.

4.7. Research design

The research was carried out in the municipality of Santa Cruz Rosales, Chihuahua.

The population of interest with which we worked were micro and small businesses within the municipality.

4.8. The sampling frame

The sampling frame was developed taking into account the INEGI database, DENU (National Statistical Directory of Economic Units). In it, micro and small businesses in the municipality of Santa Cruz Rosales can be found and identified, which will allow these businesses to be located once they are selected and the measurement instrument is applied. Eighty businesses were identified within this sector and will be numbered to facilitate their selection once the unit of analysis has been defined.

4.9. The unit of analysis

Will be all businesses in the municipality of Santa Cruz Rosales, Chihuahua, that have the following characteristics:

Valles-Alarcón, Isela Adriana, Palafox-Bolivar, Marisol Priscila, Molina-Lara, Elia Angélica and Mata-Carrasco, Hermilad. [2025]. Analysis of Problems in the Work Areas of Micro and Small Businesses in Santa Cruz Rosales, Chihuahua. ECORFAN Journal Republic of Peru. 11[19]1-11: e11119111.

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1. They are located in the urban area of the municipality of Santa Cruz Rosales, Chihuahua.
2. Have no more than 10 employees.
3. Are up to date with their tax obligations.
4. Have been in business for 5 years or more.

Based on the above, 80 companies with these characteristics were identified, and the sample will be selected.

4.10. The sampling type was non-probabilistic

In accordance with the characteristics of the work and its objectives, the elements, observation units, analysis units, or sampling units were worked with using a sample, according to the corresponding formula.

4.11. Sample size

This was determined by applying the following formula:

Finite populations

$$n' = \frac{1}{\left(\frac{1}{N}\right) + \left(\frac{1}{n}\right)}$$

Where:

n' = sample adjusted according to the population

N = population

n = sample obtained from the infinite population

A 95% confidence level will be used, with a margin of error of 5%, and the values of p and q will be the maximum for each:

$$n = \frac{(1.96)^2 * (.5)(.5)}{(0.05)^2} = 384$$

The sample is adjusted, as the population is known (point 9):

$$n = \frac{1}{\left(\frac{1}{80}\right) + \left(\frac{1}{384}\right)} = 30$$

This means that we will work with 30 companies out of the 80 that meet the characteristics mentioned in the unit of analysis.

The sample selection was done through volunteers.

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4.12. Delimitation of the research

This research is limited to the state of Chihuahua and sought to cover different micro and small companies within the municipality of Santa Cruz Rosal in the state of Chihuahua, using physical and digital surveys to complement the research, with a time period from February to June 2024.

This research adopted a mixed approach, combining quantitative and qualitative techniques. The information was collected through the application of a structured questionnaire with 18 questions and was complemented by direct observation, which allowed the data obtained to be contrasted with the real context of micro and small enterprises (MyPES).

In terms of its form, it is classified as applied research, as it seeks to generate alternative solutions to the problems detected in the access to financing of the companies analysed. The type of research was non-experimental and cross-sectional in nature, as the study variables were not manipulated, but rather existing facts were analysed over a specific period. Exploration of the subject was necessary given that empirical evidence in the municipality under study is still limited.

With regard to the research method, two approaches were used: documentary, based on bibliographic sources (books, scientific articles, journals and specialised websites), and fieldwork, through the application of questionnaires and the use of social networks as a complementary means of collecting information. The method adopted was deductive, moving from the general to the specific, to explain how the structural conditions of financing are reflected in the reality of local micro and small enterprises.

The research techniques used were surveys and observation, allowing perceptions and administrative practices to be correlated with the data obtained.

The research design was developed in the municipality of Santa Cruz Rosales, Chihuahua, considering micro and small enterprises located in its urban area as the study population. To define the unit of analysis, four comparative criteria were established:

Article

1. Location in the urban area of the municipality.
2. Number of employees equal to or less than 10 people.
3. Being up to date with tax obligations.
4. Having been in operation for at least 5 years.

These criteria made it possible to distinguish between companies with operational stability (more than five years and tax compliance) and those in a vulnerable stage (less than two years of operation or without complete records), thus establishing a relevant comparison for the analysis.

The sample frame was developed based on information from the INEGI's DENU, from which 80 companies that met the described characteristics were identified. These units were numbered to facilitate the sample selection process. The type of sampling was non-probabilistic, in accordance with the research objectives and restrictions on the availability of information.

Finally, the analysis variables were defined in two main dimensions:

- Independent variable: available sources of financing (government, private and mixed).
- Dependent variable: the development and sustainability of MyPES in the municipality of Santa Cruz de Rosales.

The relationship between the two variables made it possible to compare the influence of different financing options on the permanence and growth of local businesses.

5. Results

A questionnaire was administered to 30 micro and small entrepreneurs. The results were organised into three blocks: business orientation and control, organisational structure and work areas, and administrative and commercial management.

Box 1

Table 1

Title Guidance on how to operate the business.

Answer	Percentage	Number of responses
Yes	60%	18
No	40%	12

Source Information obtained from questionnaires.

Of those surveyed, 60% said they had received initial guidance on how to run their business, compared to 40% who did not have external support. Similarly, although 70% said they had complete control over decision-making, half of them lacked a formal method to support this process.

Box 2

Table 2

Title Length of time operating the business.

Time operating the business	Percentage	Number of responses
3 years or less	16.7%	5
3 to 6 years	23.3%	7
6 years or more	60%	18

Source Information obtained from questionnaires.

Of the 30 businesses surveyed, most have a consolidated track record: 60% have been operating for more than six years, reflecting stability and permanence in the market. In contrast, 23.3% reported between three and six years of operation, indicating that they are in a stage of growth and consolidation. Finally, only 16.7% of businesses have been in existence for three years or less, representing newly created companies that are still in the process of adaptation.

Box 3

Table 3

Title Decision-making method.

Answer	Percentage	Number of responses
Yes	36.7%	11
No	13.3%	4
Not formally	50%	15

Source Information obtained from questionnaires.

Of the 30 respondents, 50% mentioned that they keep track of inventory but not formally, reflecting the lack of standardised procedures in this area. Some 36.7% said they have structured inventory control, while 13.3% do not apply any type of control. These results show that half of businesses still do not have adequate tools or processes to efficiently manage their stock.

Box 4

Table 4

Title Different areas involved in the business.

Answer	Frequency	Porcentage
Yes	5	16.7%
No	10	33.3%
Only certain areas	15	50.0%
Total	30	100%

Source Information obtained from questionnaires.

Of the 30 businesses surveyed, 50% stated that they had a general idea of the areas that make up their organisation, reflecting a partial understanding of their company's internal structure. On the other hand, 33.3% indicated that they had not identified specific areas of work, which could indicate empirical management or a lack of functional boundaries. Finally, 16.7% of participants reported having clearly defined organisational areas, demonstrating a higher degree of formalisation and administrative planning.

In order to explore this topic in greater depth, a supplementary question was asked regarding the existence of problems or doubts in these areas of work, with the aim of detecting possible knowledge gaps, operational difficulties or business training needs, thus enabling more accurate information to be obtained on the internal management of the businesses analysed.

Box 5

Table 5

Title Problems or queries in the areas

Answer	Frequency	Porcentage
Yes	15	51.7%
No	14	48.3%
Total	29	100%

Source Information obtained from questionnaires.

Of the 30 business owners surveyed, 51.7% reported having some problems or doubts about the management of their areas of work, while 48.3% indicated that they did not have any significant difficulties, reflecting relative operational stability. These results show that more than half of the businesses need to strengthen their internal organisation and define their roles more clearly. Participants were therefore asked whether they considered training in business organisation and management to be necessary.

Box 6

Table 6

Title Training in the areas of work.

Answer	Frequency	Porcentage
Yes	11	36.7%
No	2	6.6%
Possibly	17	56.7%
Total	30	100%

Source Information obtained from questionnaires.

Of the 30 business owners surveyed, a majority of 56.7% indicated that they would possibly require training to strengthen the development of each area of the business, while 36.7% stated that they do consider such training necessary, demonstrating a widespread interest in improving the organisational and operational structure. To complement this analysis, we asked whether business owners would be willing to receive feedback on areas of work with the aim of optimising and restructuring their internal operations. The results are presented below.

Box 7

Table 7

Title Receiving feedback within these areas

Answer	Frequency	Porcentage
Yes	17	56.7%
Possibly	13	43.3%
Total	30	100%

Source Information obtained from questionnaires.

Of the 30 business owners surveyed, 56.7% said they were willing to receive feedback on areas of work, while 43.3% indicated that they would possibly agree to such guidance, reflecting a significant openness to continuous improvement and organisational restructuring.

In order to gain a deeper understanding of administrative practices, a supplementary question was asked about the existence of inventory controls in businesses, as this information provides insight into how entrepreneurs operate, what tools they use, and whether these tools are truly suited to the current needs and conditions of their companies. The results are presented below.

Box 8

Table 8

Title Inventory control

Answer	Frequency	Percentage
Yes	12	40%
No	6	20%
Not formally	12	40%
Total	30	100%

Source Information obtained from questionnaires.

Of the 30 participants surveyed, a balance was identified in the responses: 40% said they used some type of formal inventory control, while another 40% said they did so, albeit in an unstructured manner; finally, 20% acknowledged that they did not keep track of their stock at all. To gain a deeper understanding of the management and replenishment process, we inquired whether purchases from suppliers were made based on current inventory, with the aim of determining whether businesses applied planning mechanisms to their acquisitions. The results obtained allow us to infer the degree of organisation and systematisation that each economic unit maintains in the management of its material resources.

Box 9

Table 9

Title Control of income and expenditure.

Answer	Frequency	Percentage (%)
Yes	12	40
No	6	20
Not formally	12	40
Total	30	100

Source Information obtained from questionnaires.

The results show that 40% of the businesses surveyed have formal inventory control, while another 40% do so in an unstructured manner and 20% do not keep any records.

This distribution shows that, although a significant proportion recognise the need to control their stocks, informality still prevails in administrative processes, which can affect operational efficiency and strategic decision-making within economic units.

Box 10

Table 10

Title Increase in sales.

Answer	Frequency	Percentage (%)
Yes	26	86.7
No	4	13.3
Total	30	100

Source Information obtained from questionnaires.

The results show that 86.7% of the businesses surveyed have staff who have received training, while 13.3% have not provided training to their employees. This predominance reflects a business commitment to developing human resource skills and competencies, a key aspect of improving organisational efficiency and competitiveness. However, the minority percentage that does not train its staff highlights the need to strengthen the culture of continuous training within the productive sector.

6. Conclusions

The research confirms that micro and small entrepreneurs in Santa Cruz de Rosales face shortcomings in key processes, especially in accounting, inventory control, advertising, and organisational structuring. These deficiencies have an impact on service quality and operational efficiency, validating the general hypothesis.

The specific hypotheses were also accepted:

- There are problems in functional areas, particularly advertising and promotion.
- There are no clearly defined organisational charts, which limits the assignment of tasks.
- The ability to control the business is conditioned by the absence of systematic management methods and a lack of knowledge of technological tools.

Despite this, entrepreneurs show interest in training and openness to feedback, which represents an opportunity to strengthen local competitiveness. It is recommended that this line of research be continued in other municipalities in Chihuahua to identify common patterns and explain the high mortality rate of micro-businesses.

Conflict of interest

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

Contribution of the authors

Valles Alarcón, Isela Adriana: Contributed to the conception of the project, the methodological design, the writing of the manuscript, and the overall coordination of the research. Participated in the critical review of the content and the final integration of the article.

Palafox Bolivar, Marisol Priscila: Collaborated in the application of the data collection instrument, the statistical processing of the information, and the preparation of tables and figures of results.

Molina Lara, Elia Angélica: Participated in the theoretical foundation and writing of the conceptual framework and background sections, as well as in the discussion of the results obtained.

Mata Carrasco, Hermila: Contributed to the literature review, the systematisation of qualitative data, and the drafting of conclusions and recommendations aimed at strengthening the micro and small enterprises analysed.

Availability of data and materials

The data used and generated during the course of this research are available upon reasonable request to the corresponding author. The primary information comes from questionnaires administered to thirty micro and small entrepreneurs in the municipality of Santa Cruz Rosales, Chihuahua, as well as from field observations and records systematised in spreadsheets.

All materials were safeguarded for academic purposes and are archived in digital format, ensuring the confidentiality of participants and exclusive use for scientific and educational purposes.

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Abbreviations

APA	American Psychological Association
CONAHCYT	National Council for Humanities, Sciences and Technologies
DENUE	National Statistical Directory of Economic Units
ECORFAN	Financial Science and Technology Ecosystem
INEGI	National Institute of Statistics and Geography
LGAC	General Guidelines for Knowledge Application
MIPYMES	Micro, Small and Medium-sized Enterprises
MyPES	Micro and Small Enterprises
NIF	Financial Reporting Standards
NIC	International Accounting Standard
OE	Subjects of Study
PYME	Small and Medium-sized Enterprises
ROR	Research Organisation Registry
SECIHTI	ECORFAN Scientific, Technological and Innovation Evaluation System

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Supply chain performance analysis using SCOR and digital marketing: a case study in the technology sector

Análisis del desempeño de la cadena de suministro mediante SCOR y marketing digital: un estudio de caso en el sector tecnológico

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Abstract

This study evaluates the logistics performance of a microenterprise using the SCOR v13.0 model, integrating digital marketing indicators to analyze its operational and commercial impact. A mixed-methods approach was employed, based on a structured questionnaire with five dimensions of the SCOR model (Plan, Source, Make, Deliver, and Return) and a semi-structured interview with the company's CEO. The results show strengths in sourcing and delivery, as well as weaknesses in planning and returns processes, particularly due to the lack of supporting digital tools. The conceptual integration of logistics practices and digital marketing reveals opportunities for professionalization, improved customer experience, and alignment with international supply chain management standards. This study contributes to the literature by demonstrating the applicability of the SCOR model to technology-based microenterprises in the service sector and its potential when combined with digital strategies.

Resumen

El estudio evalúa el desempeño logístico de una microempresa mediante la aplicación del modelo SCOR v13.0, integrando a su vez indicadores de marketing digital para analizar su impacto operativo y comercial. Se empleó un enfoque mixto basado en un cuestionario estructurado con cinco dimensiones del modelo SCOR (Plan, Source, Make, Deliver y Return) y una entrevista semiestructurada aplicada al director general de la empresa. Los resultados muestran fortalezas en abastecimiento y entrega, así como debilidades en planificación y procesos de devoluciones, especialmente por la ausencia de herramientas digitales de apoyo. La integración conceptual entre prácticas logísticas y marketing digital evidencia oportunidades de profesionalización, mejora en la experiencia del cliente y alineación con estándares internacionales de gestión de la cadena de suministro. El estudio contribuye a la literatura al demostrar la aplicabilidad del modelo SCOR en microempresas tecnológicas de servicios y su potencial al combinarse con estrategias digitales.



Supply chain, SCOR, Digital Marketing



Cadena de suministro, SCOR, Marketing digital

Area: Development of strategic leading-edge technologies and open innovation for social transformation

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Introduction

Supply chain management has established itself as a strategic pillar for business competitiveness, particularly in organizations operating in highly technology-demanding environments. Models such as SCOR (Supply Chain Operations Reference) provide structured frameworks for diagnosing, standardizing, and improving logistics processes in companies of different sizes (Bolstorff & Rosenbaum, 2016). At the same time, the adoption of digital marketing has emerged as a determining factor in strengthening commercial presence, optimizing communication with customers, and complementing operational processes (Chaffey & Ellis-Chadwick, 2019).

In Mexico, many micro and small technology companies operate with partially structured logistics processes, which affects their internal efficiency, responsiveness, and competitive positioning. This problem manifests itself in coordination failures between departments, long delivery times, limitations in process standardization, and poor integration between operations and digital communication strategies. Added to this is the limited use of digital marketing as a tool to inform logistics decision-making, which creates gaps between customer perception and actual operational performance.

Given this situation, there is a need for a comprehensive evaluation framework that not only examines logistics performance using the SCOR model, but also analyzes how digital marketing practices can enhance information flow, improve demand visibility, and strengthen the customer experience. This premise gives rise to the central hypothesis of this study: the integration of the SCOR model with digital marketing strategies contributes to improving the logistics performance of a technology company by providing greater operational efficiency and a more comprehensive view of customer interactions.

The integration of both approaches allows for a systemic analysis of the supply chain. SCOR facilitates the evaluation of the Plan, Source, Make, Deliver, Return, and Enable processes, while digital marketing provides key information on customer behavior, satisfaction levels, demand patterns, and the effectiveness of commercial communication.

This combination makes it possible to identify areas for improvement that are not visible from a purely operational analysis and, in turn, align logistics strategies with the customer's digital experience.

In this context, the objective of this article is to evaluate the logistics performance of a Mexican technology company using the SCOR model, integrating elements of digital marketing to identify areas for improvement and establish a comprehensive diagnosis applicable to organizations with similar characteristics. This proposes an innovative approach that combines operational efficiency and customer relationship management as fundamental elements for increasing competitiveness in the technology sector.

Literary Review

Supply chain management has undergone significant evolution in recent decades, driven by the need to standardize processes, improve operational efficiency, and respond to highly competitive business environments. Among the most widely used models for logistics analysis is the Supply Chain Operations Reference Model (SCOR), initially developed by the Supply Chain Council and currently administered by the Association for Supply Chain Management (ASCM). Since its first publication in 1996, the SCOR model has established itself as an international standard for logistics performance evaluation by integrating processes, metrics, and best practices into a common framework (APICS, 2017; ASCM, 2022).

1. Evolution and adoption of the SCOR model

The SCOR model structures the supply chain through five fundamental processes: Plan, Source, Make, Deliver, and Return, to which the Enable process has been added in more recent versions. This structure allows for comprehensive evaluation from strategic planning to physical and information flows. Authors such as Bolstorff and Rosenbaum (2016) highlight that SCOR provides clarity in metrics, facilitates comparison with global standards, and guides the implementation of continuous improvement initiatives.

Recent research has expanded its application to various sectors, including manufacturing, food, logistics services, and SMEs. Adam, M. *et al.* (2020), for example, demonstrated that SCOR is effective for measuring performance in complex supply chains, while Prasetyaningsih *et al.* (2020) confirmed its usefulness in contexts with limited resources. Likewise, the incorporation of the SCOR Digital Standard (DS) has made it possible to link logistics activities with emerging technologies such as IoT, data analytics, and automation (Özkanlisoy, Ö 2023).

2. SCOR applied to SMEs

Although much of the literature on SCOR focuses on manufacturing and large companies, recent studies highlight its relevance for small businesses in the technology sector. Nguyen, T.T.H (2024) demonstrated that SCOR allows bottlenecks to be identified, logistics maturity levels to be measured, and performance benchmarks to be established for companies with flexible operating models. Additionally, Zhang, S. (2024) expanded the discussion by validating the model in technology product companies, concluding that SCOR facilitates alignment between operational processes, sourcing, and supplier relationships.

In Latin American contexts, Zuluaga Mazo *et al.* (2014) highlight the need for standardized tools that enable SMEs to address the lack of indicators and limited digitization. This is particularly relevant for technology microenterprises that depend on delivery times, inventory availability, and efficient returns management to compete in saturated markets.

3. Convergence between logistics and digital marketing

The growing digitization of markets has driven integration between logistics and digital marketing. Chaffey & Ellis-Chadwick (2019) argue that digital marketing has become an indispensable component for customer acquisition, retention, and loyalty, especially in technology sectors where users seek immediate information, product availability, and technical support.

In this regard, Masa'deh *et al.* (2023) document that the integration of marketing and logistics promotes synchronization between supply and demand, optimizes the customer experience, and improves the visibility of logistics processes. They add that SMEs often lack formal digital strategies, which limits their competitiveness, even when they have functional logistics processes.

The literature also emphasizes the importance of digital content as a tool for improving customer trust. Castilla *et al.* (2023) argue that technology companies that publish specialized content strengthen their credibility, reduce consumer uncertainty, and improve business performance, which is directly linked to the Make dimension of the SCOR model when adapted to technical service contexts.

4. After-sales management and its impact on SCOR

Several studies highlight the importance of the Return process within the SCOR model, as its proper management directly influences customer satisfaction, company reputation, and repeat purchases. Zambrano, L. E. & Zaldumbide, D.A. (2023) state that after-sales has become a key differentiator in technology companies, where customers demand immediate support, clear policies, and traceability in returns.

Dias, A & Pereira, L (2025) conclude that the absence of formal return policies generates negative perceptions about the seriousness and professionalism of companies, regardless of the quality of their products or services. This finding is particularly relevant for micro-enterprises that depend on local prestige and customer recommendations

5. Need for SCOR–digital integration in technology companies

Finally, the literature agrees that integrating SCOR with digital tools accelerates logistics maturity and significantly improves responsiveness Zambrano, L. E. & Zaldumbide, D.A.(2023); ASCM, (2022). Models such as DigitalSCOR propose a vision where information, indicators, and customer experience converge in standardized, accessible, and measurable processes.

For tech micro-enterprises, this convergence represents a viable route to professionalizing their operations without requiring large investments, through the use of simple tools such as digital forms, technical content, basic traceability, and SEO strategies.

Methodology

The study was conducted using a mixed approach and a case study design. The unit of analysis was a technology microenterprise located in Querétaro, Mexico, specializing in the sale of technology accessories and video surveillance services.

Two instruments were used: first, the adapted SCOR v13.0 questionnaire, consisting of 25 items on a Likert scale, grouped into the five dimensions of the model. In addition, a semi-structured interview was conducted with the CEO, covering five categories: operations, supply, logistics, digital marketing, and areas for improvement.

Data collection took place between June and July 2025. Averages were obtained for each dimension of the SCOR model and triangulated with qualitative evidence from the interview. Given the sample size, descriptive and exploratory correlational analysis was applied.

Results

The results indicate that the company lacks formal mechanisms for anticipating demand, managing inventory variability, and establishing performance metrics. Planning practices are carried out reactively, based on the CEO's experience rather than predictive or analytical models.

It was also identified that:

- Generally, no digital tools are used to simulate scenarios or analyze sales trends.
- There is also no formal supply schedule based, for example, on previous orders or past years' behavior.
- Inventory planning is not aligned with digital marketing guidelines, which causes peaks in demand without logistical forecasting.

This coincides with information obtained from the literature, which indicates that technology SMEs tend to operate intuitively, with little systematization in demand forecasting (Ouyang & Huang, 2024).

Source Dimension (4.0/5) – Strengths in strategic relationships and reliable supply

The highest rating after Deliver corresponds to Source. The company maintains strong relationships with key suppliers (Dahua, TP-Link, Steren), supported by:

- Digitized purchasing processes through electronic transfers and orders.
- Stable delivery times.
- Availability of technical support from strategic suppliers.
- Continuous training provided by specialized brands.
- However, there are still opportunities for improvement in:
- Absence of supplier evaluation metrics.
- Lack of comparative analysis of prices and response times.
- High dependence on a single dominant supplier (Dahua).

Make Dimension (3.8/5) – Good operating standard but no technical indicators

This dimension, adjusted to the context of technical services, showed favorable performance due to:

- Empirical standardization of installation and maintenance processes.
- High service customization.
- Efficient management of internal warranties.
- However, the following were found to be lacking:
- Productivity indicators.
- Digital records of installation times.
- Standardized technical documentation for customers and internal staff.

This limits the possibility of establishing technical benchmarking or demonstrating added value in digital channels.

Delivery Dimension (4.5/5) – Stronger logistics system

- The Delivery dimension received the highest score in the study. The associated factors were:
- Efficient fulfillment of deliveries and services.
- Direct communication via WhatsApp with immediate response times.
- Flexibility for in-store or home deliveries.
- Personalized service that enhances customer satisfaction.
- The main weaknesses identified were:
- Lack of digital traceability.
- Lack of public policies on social media delivery.
- There is no notification or order tracking system.

Return Dimension (2.8/5) – The main weakness of the system

The return and after-sales processes showed significant shortcomings:

- There are no visible return policies for customers.
- The process depends entirely on the intervention of the CEO.
- There are no records or indicators regarding reasons for returns.
- The company does not use digital tools to manage warranties.

This dimension is critical for technology companies, where after-sales service is a key factor in customer loyalty (Zambrano, L. E. & Zaldumbide, D.A., 2023).

Box 1

Table 1

Comparison of performance by SCOR dimension vs. literature standards

Dimension	Result	Expected standard	Gap
Plan	3.2	4.0–4.5	High
Source	4.0	4.0–4.6	Medium
Make	3.8	4.0	Moderate
Deliver	4.5	4.0–4.5	Low
Return	2.8	3.5–4.0	Critical

Note: The table shows that Plan and Return have the widest gaps, while Deliver and Source are close to international standards, although with key areas for digital improvement

Box 2

Table 2

Relationship between current practices and SCOR requirements

Dimension	Current practice	Requirement SCOR	Compliance
Plan	Reactive planning	Demand analysis, KPIs	Low
Source	Digital purchasing, stable suppliers	Formal supplier evaluation	Medium-high
Make	Good technical performance	Indicators, documentation	Medium
Deliver	Fast deliveries	Digital traceability	High
Return	Manual processes	Visible policies, digital management	Very low

Note: The results show that the company operates efficiently in Deliver and Source, but needs to migrate to a formal scheme in Plan, Make, and especially Return.

Box 3

Table 3

Comparison of findings and literature

Finding	Consistency with literature	Implication
Weakness in planning	Frequent in SMEs (Ouyang & Huang, 2024)	Operational risk
Strength in supply	Effective strategic relationships (Lima-Junior, 2019)	Competitive advantage
Good performance in delivery	Influences customer satisfaction (Silva et al., 2023)	Loyalty
Poor returns	Lack of processes affects trust (Romero & Torres, 2022)	Reputational risk
Limited digital marketing	Common pattern in SMEs (Jiménez & Pérez, 2021)	Low Visibility

Note: The patterns identified in the company are consistent with those observed in multiple studies on technology SMEs: operational strength, analytical weakness, and lack of structured digitization.

Box 4**Table 4**

Relationship between digital marketing and SCOR

Digital element	Expected impact	Current situation	Gap
Social media	Synchronize Plan and Deliver	Irregular frequency	High
SEO/Google Maps	Greater visibility	Profile without active management	Medium
Technical content	Improve Make and trust	Does not exist	High
WhatsApp Business	Improve Deliver	Inefficient use	Low
Forms and tracking	Improve Return	Not implemented	High

Note: The lack of integration between digital marketing and SCOR limits the company's potential for growth and professionalization.

The results show that the SCOR model is a relevant tool for diagnosing the supply chain in technology micro-enterprises. The heterogeneity of the scores confirms that these organizations tend to combine efficient operational practices with structural weaknesses, as suggested by Adam, M. *et al* (2020) & Prasetyaningsih *et al.* (2020).

The reactive planning observed coincides with logistics maturity models in SMEs, where the lack of demand analysis and the absence of digital tools represent significant constraints to growth (Ouyang & Huang, 2024). Likewise, strength in sourcing is in line with the literature that argues that stable relationships with suppliers can partially compensate for the lack of formal systems, Deku, W.A., Wang, J., & Preko, K. (2024).

In the operational sphere, the Make dimension showed technical efficiency but a lack of documentation, which is consistent with studies that highlight the importance of content marketing in reinforcing professional perception in technology sectors. The Deliver dimension, with the highest score, confirms that personalized attention and immediate response time are key factors in the customer experience of technology products. However, the lack of traceability affects the transparency of the process, an essential element for advanced digital models such as DigitalSCOR.

Finally, the Return dimension, which is the weakest, constitutes the main strategic risk. Its status contrasts with the best practices described by Adam, M. *et al.* (2020), who point out that after-sales management is crucial for customer loyalty and corporate reputation.

The integration of digital marketing into the analysis reveals a structural disconnect between digital presence and logistics operations. The evidence confirms that the company lacks technical content, public policies, digital metrics, and positioning strategies, a common situation in Mexican micro-enterprises (Gutiérrez-Leefmans, C. *et al*, 2021). This disconnect limits the business's ability to align demand, provide clear information, and improve customer confidence.

Conclusions

The comprehensive analysis carried out using the SCOR model, complemented by an evaluation of digital marketing strategies, made it possible to accurately identify the strengths, weaknesses, and opportunities for improvement in the technology microenterprise studied. First, it confirms that the SCOR model continues to be a robust, systematic, and adaptable tool for diagnosing the logistics performance of organizations regardless of their size, provided that the dimensions of the model are properly contextualized to the nature of the business processes. The evaluated company showed remarkable performance in the Source and Deliver dimensions, demonstrating efficient relationships with its suppliers, competitive response times, and personalized customer service. These elements represent strategic assets that directly contribute to the end consumer's perception of professionalism and reliability.

However, the research also revealed critical areas that require priority attention to improve the overall efficiency of the supply chain. The Plan dimension is affected by the absence of formal demand forecasting mechanisms, as well as the lack of key performance indicators to assess inventory stability, sales variability, or responsiveness. Logistics operations, although functional, continue to rely on intuitive or experience-based decisions, limiting the possibility of adopting strategic planning that would allow for anticipating market behavior, adjusting purchases to demand cycles, and avoiding losses due to overstocking or shortages.

The Return dimension is the most significant challenge identified in the analysis. The lack of clear return policies, systematic processes for warranty management, and digital tools that enable post-sale traceability puts the company in a vulnerable position compared to more structured competitors. In technology markets, where trust, technical support, and after-sales service are critical factors in customer loyalty, the lack of standardization can negatively impact the business's reputation, even when customer service is responsive and efficient.

In terms of digital marketing, the study shows that the company maintains a limited and functional digital presence, based mainly on direct channels such as WhatsApp and Google Business. However, this presence lacks content strategies, performance metrics, SEO positioning, or integration with logistics processes. The underutilization of digital tools limits the organization's ability to increase its visibility, attract new customers, and transparently communicate key aspects such as inventory availability, promotions, commercial policies, or delivery times.

The conceptual integration between SCOR and digital marketing leads to the conclusion that logistics professionalization does not depend solely on advanced technological infrastructure, but also on the ability to standardize processes, document procedures, implement indicators, and use accessible digital tools geared toward communication, monitoring, traceability, and analysis. Finally, it is recommended to move towards the implementation of visible return policies, digital service forms, basic logistics metrics, valuable technical publications, and a digital plan aligned with operational cycles. These actions would reduce customer uncertainty, improve the overall efficiency of the supply chain, and strengthen the company's competitiveness in a dynamic and demanding technological market.

Declarations

Conflict of interest

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

Author contribution

Bárceñas-Nava, Ma. de los Angeles: Contributed to the writing, structure, data analysis, and editing of the original draft.

Trujillo-Beltrán, Elisa: Contributed to the project design and drafting.

Ramírez-Mendoza, Maximiliano: Contributed with analysis of results.

Kido-Miranda, Juan Carlos: Contributed by reviewing the original draft and structure.

Availability of data and materials

The data supporting this research are available upon reasonable request to the corresponding author.

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Abbreviations

List abbreviations in alphabetical order.

SCOR	Supply Chain Operations Reference
PyMEs	Small and medium-sized enterprises
DS	Digital Standard
IoT	Internet of Things
ASCM	Association for Supply Chain Management
APICS	American Production and Inventory Control Society
SEO	Search Engine Optimization
TP Link	Twisted Pair Link
KPIs	Key Performance Indicator

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Organizational agility in the Tourism Sector: Effects of corporate culture on the agile experience




Agilidad Organizacional en el Sector Turismo: Efectos de la cultura empresarial en la experiencia ágil

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Abstract

The purpose of this research was to understand the effects of corporate culture on the agile experience of PYMES in the accommodation and food and beverage preparation services of the tourism sector in a city in southern Sonora, in order to contribute to their development and competitiveness. To this end, a quantitative study was developed. The design was non-experimental, correlational, and cross-sectional. The study subjects were decision-makers at PYMES; the sample was non-probabilistic with a convenience quota. The instrument was applied, data was collected, the correlation between Corporate Culture and Agile Experience was determined, and finally, the results were analyzed and discussed. The conclusion was that the level of adoption of agile organizations was high, and it was determined that corporate culture does positively and significantly affect the agile experience.

Organizational Agility in the Tourism Sector: Effects of Corporate Culture on the Agile Experience		
Objetivo	Methodology	Contribution
To understand the effects of corporate culture on the agile experience of PYMES in the accommodation and food and beverage services sector in a city in southern Sonora.	The instrument was applied, data was collected, the correlation between Business Culture and Agile Experience was determined, and finally the results were analyzed and discussed.	Generate knowledge that serves as a basis for strengthening business culture, improving the agility, innovation capacity, and adaptation of tourism PYMES in the region.

Agility, Tourism, Culture

Resumen

El propósito de la presente investigación, fue conocer los efectos de la cultura empresarial en la experiencia ágil de las PYMES de servicios de alojamiento y preparación de alimentos y bebidas del sector turismo de una ciudad del sur de Sonora, para contribuir a su desarrollo y competitividad. Para ello se desarrolló un estudio de enfoque cuantitativo, el diseño fue no experimental, de tipo correlacional y transversal, el sujeto de estudio fueron los tomadores de decisiones de las PYMES, la muestra fue no probabilística de cuota por conveniencia. Se aplicó el instrumento, se recolectaron los datos, se determinó la correlación entre Cultura Empresarial y Experiencia Ágil y finalmente se analizaron y discutieron los resultados, teniendo como resultado que el nivel de adopción de organizaciones ágiles fue alto y se logró conocer que la cultura empresarial si afecta de manera positiva y significativa la experiencia ágil.

Agilidad Organizacional en el Sector Turismo: Efectos de la Cultura Empresarial en la Experiencia Ágil		
Objetivo	Método	Contribución
Conocer los efectos de la cultura empresarial en la experiencia ágil de las PYMES de servicios de alojamiento y preparación de alimentos y bebidas de una ciudad del sur de Sonora.	Se aplicó el instrumento, se recolectaron los datos, se determinó la correlación entre Cultura Empresarial y Experiencia Ágil y finalmente se analizaron y discutieron los resultados	Generar conocimiento que sirva como base para fortalecer la cultura empresarial, para mejorar la agilidad y la capacidad de innovación y adaptación de las PYMES turísticas en la región

Agilidad, Turismo, Cultura

Area: Advocacy and attention to national problems

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Introduction

Currently, organizations are immersed in a complex and dynamic environment, where the primary challenge for decision-makers lies in detecting early signals of change in markets before these evolve into established trends, thereby missing the opportunity to capitalize on them (Gómez *et al.*, 2023).

According to Quiroga, Martín, and Baldivieso (2021), volatility, uncertainty, complexity, and ambiguity (VUCA)—an acronym derived from the English terms *Volatility (V)*, *Uncertainty (U)*, *Complexity (C)*, and *Ambiguity (A)*—describe a new reality characterized by complex and shifting contexts in which organizations are compelled to adapt and develop responsive capabilities due to the continuous transformations impacting their strategies.

Innovation and the adoption of emerging technological trends are driving accelerated changes in business models, leaving traditional organizations struggling to respond due to their rigidity and slow adaptability to the dynamics of the current environment (Lapicki & Terlato, 2021).

To respond to the ongoing evolution of organizational ecosystems, agility has become a key factor in enhancing organizational performance. More flexible models must be adopted, and a culture of agility cultivated among individuals, thereby identifying the most effective strategies for adapting more rapidly to changing environments (Pacheco, 2023).

The capacity to swiftly guide an organization toward agile practices enhances team performance. This, in turn, facilitates experimentation and validation of ideas prior to their implementation (Comella, Kaur, & Zaidi, 2019).

Agile organizations remain competitive by focusing on their objectives while effectively responding to unpredictable market changes. In essence, strategic agility refers to a company's ability to rapidly realign its direction, adapting to emerging needs, opportunities, and trends (Clauss *et al.*, 2021).

According to Aghina *et al.* (2017), an agile organization consists of teams operating within a member-centered culture, functioning through rapid cycles of learning and decision-making, and leveraging technology to generate value for all stakeholders. This combination provides organizations with both agility and stability, granting them a critical advantage in challenging VUCA environments.

Similarly, Gómez *et al.* (2023) emphasize that organizational agility is a company's ability to swiftly identify and respond to changes in its environment, enabling it to seize market opportunities more effectively.

Rotundo *et al.* (2015) argue that, in order to remain competitive, decision-makers must strengthen their firms' strategic processes, ensuring optimal performance of internal factors while improving control over the external variables in which they operate.

A process of organizational change aimed at leveraging new technologies to enhance operational efficiency, systems, and human resource management—thereby creating greater value for the customer—extends far beyond the simple adoption of digital tools. It requires a transformation that encompasses organizational culture and involves a thorough reassessment of the company's structure (Arango *et al.*, 2018).

Today's organizations must adopt a forward-looking vision, which entails implementing continuous and dynamic processes to adjust their strategies in response to environmental demands. This adaptability allows them to meet customer needs, deliver enhanced experiences, and remain aligned with market transformations and shifting consumer behavior. Consequently, organizations must engage in ongoing ideation and process improvement, which requires a sustained commitment to innovation (Valderrama, 2019).

In Mexico, Small and Medium-Sized Enterprises (PYMES) account for 99.8% of businesses with economic activity. They play a pivotal role in strengthening the economy, fostering local development, and generating positive social impact. PYMES drive economic performance by producing 52% of national revenues and employing 68% of the country's workforce in the business sector (Secretaría de Economía, 2024).

According to the National Institute of Statistics and Geography (INEGI, 2024), tourism contributed 8.6% to Mexico's Gross Domestic Product (GDP) in 2023, establishing itself as a strategic sector of high relevance. Moreover, the National Statistical Information System of the Tourism Sector of Mexico (DATATUR, 2025) reported that in January 2025, Mexico received 3.9 million international tourists, representing an 8.5% increase compared to 2024.

At the state level, Sonora's Secretariat of Economy and Tourism (2024) highlighted a significant growth in tourism, reporting a 15% increase in visitor numbers in 2024 compared to the previous year.

As Gretzel *et al.* (2015) note, technology and globalization play a central role in shaping consumer activities, transforming expectations and compelling organizations to undergo inevitable change. Such evolution is essential for ensuring their continued operation and long-term success in the current market.

The tourism industry has undergone significant transformations. According to García (2017), access to online information has empowered users to independently manage their trips, taking into account key elements such as price, destination, and timing. For Ghaderi (2018), the travel experience is shaped by how tourists perceive the services and products offered, which can be further enhanced through technological support.

However, when analyzing PYMES in Mexico, it becomes evident that their main weakness lies in the scarcity of business information and the lack of integration. Many of these firms lack the necessary procedures, techniques, and standards to ensure long-term success, devoting limited time to such activities—often due to lack of knowledge. Consequently, they must strengthen both their organizational culture and structure in order to transform (Sánchez & Hernández, 2020).

This study was conducted among accommodation and food and beverage service companies within the tourism sector in a city in southern Sonora. Findings indicate that a traditional business culture prevails, and responses to change tend to be slow, which leads to inefficiencies in meeting customer needs and reduced competitiveness.

In light of this context, the following research question arises: To what extent does organizational culture influence agile experience in PYMES providing accommodation and food and beverage services within the tourism sector of a city in southern Sonora?

Based on this, the objective of the study was to examine the effects of organizational culture on the agile experience of PYMES in the accommodation and food and beverage service sector of a city in southern Sonora, with the aim of contributing to their development and competitiveness.

The study was guided by the following hypotheses:

- H0: Organizational culture does not affect the agile experience of PYMES providing accommodation and food and beverage services within the tourism sector of a city in southern Sonora.
- H1: Organizational culture affects the agile experience of PYMES providing accommodation and food and beverage services within the tourism sector of a city in southern Sonora.

Tourism holds significant economic importance for countries, driving growth that is reflected in both revenue generation and job creation. In this context, it is crucial to understand what tourists seek in each destination in order to maximize the use of available resources (Figueredo, 2017).

The relevance of this research lies in generating knowledge that serves as a foundation for strengthening organizational culture, thereby enhancing the agility, innovation capacity, and adaptability of tourism PYMES in the region.

This paper is structured into six sections. It begins with an introduction presenting the research question and objectives, followed by the methodology, which details the type of study, variables, and period of analysis. The third section presents the results, while the fourth and fifth are dedicated to acknowledgments and funding sources, respectively. Finally, the document concludes with the main findings of the research.

Methodology

A quantitative study was conducted with a non-experimental, correlational, and cross-sectional design, where the variables under examination were Organizational Culture and Agile Experience. According to Hernández *et al.* (2014), the purpose of a quantitative approach is to define reality with the greatest possible accuracy. A non-experimental design is characterized by the absence of deliberate manipulation of variables, while correlational studies aim to establish the degree of association between two or more variables. In cross-sectional studies, data are collected at a single point in time.

The study population consisted of decision-makers from PYMES in the accommodation and food and beverage service sector of a city in southern Sonora, with a total of 100 participants.

The sampling method was non-probabilistic, specifically quota sampling by convenience, as the only requirement was that the decision-maker be a collaborator of the PYMES in the accommodation and food and beverage sector and willing to participate voluntarily.

A diagnostic instrument for the adoption of agile organizations, adapted from the Agile Manifesto, was applied. The instrument consisted of 30 items, and participants' responses reflected the extent to which they adopt agile organizational practices. These items were grouped into five dimensions: Agile Experience, Organizational Culture, Cross-functional Collaboration, Customer Feedback, and Organizational Vision. A five-point Likert scale was used, where Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, and Strongly Agree = 5.

For the analysis, three levels of agile organization adoption were established, as presented in Table 1. Dimension-specific and overall means were calculated. Additionally, the correlation between variables was assessed using Pearson's coefficient with a significance level of 0.05. McDonald's Omega was employed to evaluate the internal consistency of the measurement instrument. Linear regression analysis and the statistical significance test for the correlation coefficient (*t*-test) were also conducted using the R software, version 4.3.3.

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Box

Table 1

Levels of Agile Organization Adoption

Level	Lower value	Upper value
Low	1.0	3.0
Intermediate	3.1	4.0
high	4.1	5.0

Source: Authors' elaboration (2025).

The procedure followed for the development of the research was to apply the instrument, then collect the data, determine the validity and reliability of the instrument using Cronbach's Alpha and McDonald's Omega, determine the level of adoption of agile organizations, examine communication between Business Culture and Agile Experience, and finally, analyze and discuss the results.

Results

For the validity and reliability analysis of the instrument responses, the general cronbach's alpha coefficient was calculated and by dimension (see Table 2), obtaining a general average of 0.97, 0.91 for the Agile Experience dimension, 0.93 for Cross-Functional Collaboration, 0.90 for the Corporate Culture dimension, 0.76 for the Customer Feedback dimension, and 0.78 for the Organizational Vision dimension, demonstrating good consistency in the responses.

Box

Table 2

Reliability statistics, Cronbach's alpha

Dimensions	Cronbach's alpha
Agile Experience	0.91
Cross-Functional Collaboration	0.93
Corporate Culture	0.90
Customer Feedback	0.76
Organizational Vision	0.78
General average	0.97

Source: Authors' elaboration (2025).

The McDonald's Omega coefficient was also applied to measure the instrument's internal consistency, yielding a score of 0.98, indicating that the instrument's items consistently measure the same construct.

Regarding the level of adoption of agile organizations, a general value of 4.3 was obtained, with the Agile Experience dimension at 4.2, Interfunctional Collaboration at 4.4, Business Culture at 4.1, Customer Feedback at 4.4, and Organizational Vision at 4.2. This shows that the level of adoption of agile organizations in general average and by dimension is high.

In addition, an analysis was conducted to determine the relationship between the Business Culture and Agile Experience variables using the Pearson correlation coefficient and the statistical significance test for the correlation coefficient (t-test).

It is important to note that calculating the correlation coefficient does not guarantee that there is an association between the variables. Therefore, it is recommended to calculate whether the coefficient is statistically significant to confirm whether a correlation exists. This test is based on the premise that the null hypothesis (H0) assumes no association between the variables, while the alternative hypothesis (H1) assumes an association between the variables.

As can be seen in Table 3, the correlation result is positive with a value of 0.893 showing a strong correlation, with a confidence interval of 95%, where the p-value or probability value (p-value) is equal to 2.2e-16, being less than the reference significance level of 0.05, the null hypothesis (H0) is not accepted, which indicates that the correlation coefficient obtained is statistically significant, in addition the confidence interval by excluding zero confirms this result.

Box

Table 3

Pearson correlation and statistical significance test

t = 19.726, df = 98, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
0.8458405 0.9273830
Cor: 0.8937692

Source: Authors' elaboration (2025).

Once it was confirmed that the Agile Experience is affected by the Business Culture, a simple linear regression model was developed (see table 4) to delve deeper into the behaviors and correlations, as a result the intercept was 4.22400 (expected value of the dependent variable when the independent variable is zero) and 0.75426 for the slope that is related to the Business Culture, with this it is observed that the slope predicts an increase of 0.75426 in the Agile Experience variable for each increase in the Business Culture variable. In addition, resulting in a p-value: 2.00e-16, which indicates that it is statistically significant since it is less than the reference significance level of 0.05, so the alternative hypothesis (H1) that there is an affectation between the variables is accepted.

Box

Table 4

Linear regression model between the Agile Experience variable and Business Culture

Intercept	Business Culture	P-Value
4.22400	0.75426	2.00e-16

Source: Authors' Elaboration (2025)

It can be observed from the research results that the Agile Experience is positively affected by Corporate Culture, which means that as a culture of change is fostered among employees and strengthened, so too is the Agile Experience.

Therefore, the results coincide with the author [Blanco \(2023\)](#), where he mentions that agile organizations are distinguished by their dedication to establishing a shared understanding and purpose, fostering trust, respect and the creation of valuable work ties in their collaborators, by a vision of change that is significant for their structure, and the empowerment of their collaborators as an essential skill for their operation.

Conclusions

Organizational agility has gained significant relevance, especially in these volatile times. Although these topics have been discussed for some time, their true importance has not always been recognized. Today's organizations need a vision for the future to be able to respond to changing environments and quickly take advantage of market opportunities.

As previously mentioned, tourism is one of Mexico's main economic sectors, generating significant growth through its economic impact and job creation. Hence, it is important for PYMES in the tourism sector to develop strategies that allow them to transform into agile organizations and foster a culture of change among their employees, enabling them to respond to market needs.

Through the development of this research, it was discovered that corporate culture does positively and significantly impact the agile experience in PYMES providing accommodation and food and beverage services in the tourism sector of a city in southern Sonora. These findings offer a solid foundation for improving corporate culture, thus boosting their agility, capacity for innovation, and adaptation.

Finally, it can be noted that the level of adoption of agile organizations in the PYMES studied is high. This indicates that they are implementing and utilizing agility principles, practices, and values that allow them to compete in a dynamic environment, offering better experiences to their customers. Given the relevance of this topic, it is important to continue developing research in other sectors and in general.

Declarations

Conflict of interest

The authors declare no conflicts of interest. They have no financial interests or personal relationships that could have influenced the submission of this article.

Author contribution

Hinojosa-Rodríguez, Carlos Jesús: Project idea, bibliographic review, resources, writing, editing, proofreading, data analysis, formulation of results.

De la Mora-Yocupicio, Arturo: Project idea, writing, editing, proofreading, bibliographic review.

Moncayo-Rodríguez, Lizette Marcela: Project idea, bibliographic review, data collection, writing, editing.

Quiroz-Campas, Celia Yaneth: Bibliographic review, data collection, writing, editing.

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Availability of data and materials

The instrument used in this research can be requested from: carlos.hinojosa@itson.edu.mx

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Abbreviations

DATATUR	National Statistical Information System of the Tourism Sector of Mexico.
INEGI	National Institute of Statistics and Geography.
PYMES	Small and Medium-Sized Enterprises.
VUCA	Volatility (V), Uncertainty (U), Complexity (C) y Ambiguity (A)

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The Community High School student as an agent of environmental change. Tres Marías Morelos

El estudiante de Preparatoria Comunitaria como agente de cambio ambiental. Tres Marías Morelos

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Abstract

This study analyzes the pedagogical role of the Tres Marías Community Preparatory School as a trainer of environmental change agents. Its location in the Chichinautzin Biological Corridor provides it with a privileged context for linking education and territory. Based on a questionnaire administered to 129 students (62.7% women, 35.6% men, and 1.5% other), perceptions, knowledge, and willingness to act regarding climate change were explored. The results reveal a high level of awareness: 93.3% attribute the rise in temperature to human causes, and 60% consider climate change a current and serious threat. 71.3% trust scientists and teachers as sources of information, highlighting the role of schools in building environmental knowledge. However, gaps were identified regarding national policies, highlighting the need to strengthen the political dimension of the curriculum. Overall, the experience confirms that community high schools develop student profiles with the skills to pedagogically impact their communities.

Resumen

Este estudio analiza la función pedagógica de la Escuela Preparatoria Comunitaria de Tres Marías como formadora de agentes de cambio ambiental. Su ubicación en el Corredor Biológico Chichinautzin le otorga un contexto privilegiado para vincular educación y territorio. A partir de un cuestionario aplicado a 129 estudiantes (62.7 % mujeres, 35.6 % hombres y 1.5 % otro), se exploraron percepciones, conocimientos y disposición a la acción frente al cambio climático. Los resultados revelan un alto grado de conciencia: 93.3 % atribuye el aumento de la temperatura a causas humanas y 60 % considera al CC una amenaza actual y seria. El 71.3 % confía en científicos y docentes como fuentes de información, lo que resalta el papel de la escuela en la construcción del conocimiento ambiental. Sin embargo, se detectan vacíos en torno a las políticas nacionales, lo que evidencia la necesidad de reforzar la dimensión política del currículo. En conjunto, la experiencia confirma que las preparatorias comunitarias consolidan perfiles estudiantiles con competencias para incidir pedagógicamente en sus comunidades.

Title: The Community High School Student as an Agent of Environmental Change. Tres Marías Morelos.		
1. Objective: To analyze the pedagogical role of the Community Preparatory School as a trainer of environmental change agents. The case of Tres Marías is considered due to its location in the Chichinautzin Biological Corridor, which provides a privileged context for linking education and land.	2. Method: Instrument: Structured questionnaire. Sample: 129 students from the Tres Marías Community Preparatory School. Variables: Knowledge, perception, sources of information, daily practices, and willingness to act on climate change. Analysis: Basic quantitative (frequencies and percentages) and qualitative contextual (link to the region and comparison with 2014).	3. Contributions Provides evidence on youth environmental awareness in ecologically strategic areas. Demonstrates the relevance of a territorial pedagogical approach in upper secondary education. Reinforces the idea that community high schools can train agents of environmental change. Suggests greater trust in scientists and teachers as sources of information on climate change. Contributes to the design of educational policies with an ecosocial and territorial approach.

Título: El estudiante de Preparatoria Comunitaria como agente de cambio Ambiental. Tres Marías Morelos.		
1.-Objetivo: Analizar la función pedagógica de la Escuela Preparatoria Comunitaria como formadora de agentes de cambio ambiental. Se retoma el caso de Tres Marías por su ubicación en el Corredor Biológico Chichinautzin lo que le otorga un contexto privilegiado para vincular educación y territorio.	2.-Método: Instrumento: Cuestionario estructurado. Muestra: 129 estudiantes de la Escuela Preparatoria Comunitaria de Tres Marías. Variables: Conocimiento, percepción, fuentes de información, prácticas cotidianas y disposición a actuar frente al cambio climático. Análisis: Cuantitativo básico (frecuencias y porcentajes) y contextual cualitativo (vinculación con territorio y comparación con 2014).	3.-Contribuciones Aporta evidencia sobre la conciencia ambiental juvenil en zonas ecológicamente estratégicas. Demuestra la relevancia del enfoque pedagógico territorial en la educación media superior. Refuerza la idea de que las preparatorias comunitarias pueden formar agentes de cambio ambiental. Sugiere una mayor confianza en científicos y docentes como fuentes de información frente al cambio climático. Contribuye al diseño de políticas educativas con enfoque ecosocial y territorial.

Community pedagogies, agents of change, natural areas

Pedagogías comunitarias, agentes de cambio, área natural

Area: Advocacy and attention to national problems.

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Introduction

Climate change represents one of the greatest challenges of our time, with direct consequences on ecosystems, human health, the economy, and social stability. Several studies have identified the need for environmental education that not only informs but also shapes critical individuals capable of acting in response to environmental issues. As Pérez *et al.* (2025) emphasize, contemporary methodological trends in education seek to integrate theoretical and practical knowledge, fostering critical reflection and innovation in learning processes.

In this context, the study presented by Jiménez-Ávila, Sánchez Salina, and Ortiz-Hernández (2014) at the XIII International Congress and XIX National Congress of Environmental Sciences, titled Perception of Climate Change among Upper Secondary Students in the State of Morelos, revealed that although there is general knowledge about climate change at this educational level, misunderstandings persist, as well as a gap between environmental awareness and concrete action. These findings are consistent with what Magallanes Delgado *et al.* (2025) describe as the need for educational practices that promote international dialogue and shared learning between diverse academic communities, reinforcing pedagogical innovation through comparative and contextualized approaches.

Given this situation, the present study on the perception of climate change at the Escuela Preparatoria Comunitaria de Tres Marías revisits and updates the findings of the 2014 research from a contextualized, technical, and territorial perspective, recognizing students not only as subjects of analysis but also as agents with transformative potential.

This new research is relevant as it focuses on a school offering specialized education in environmental and community topics, allowing for a deeper analysis of the relationship between technical training, environmental knowledge, and dispositions toward action. Such an approach aligns with the view of the Red de Investigadores Latinoamericana (2025), which highlights scientific dissemination as a socially transformative practice that connects research with communities and strengthens citizen participation in environmental decision-making.

Moreover, this updated study is framed within a context in which the impacts of climate change, global awareness of the environmental crisis, and the demands on educational systems to respond with more comprehensive, interdisciplinary, and place-based approaches have intensified. Yaxi, Rodríguez, and Pérez (2025) underscore that understanding territorial systems requires acknowledging the ecological, cultural, and social dimensions that shape them, an idea central to designing education that fosters environmental agency. Similarly, Ruiz y Limón (2025) show that creative and expressive pedagogical tools, such as poetry, can nurture empathy, dialogue, and a culture of peace among youth, principles that are equally essential for environmental education aiming to cultivate care and collective responsibility.

Thus, the current research represents an opportunity to move from diagnosis to pedagogical action, strengthening the role of rural high schools as incubators of environmental promoters, community technicians, and citizens committed to the ecological and social future of their region (Programa educativo 2022. Reestructuración Escuela Preparatoria Comunitaria de Tres Marías).

The *Escuela Preparatoria Comunitaria de Tres Marías*, under the supervision of the Universidad Autónoma del Estado de Morelos (UAEM), is in the municipality of Huitzilac, Morelos. This municipality lies in the northwest of the state and covers an area of 189.1 km², representing 3.9% of the state's total territory (Síntesis estadística municipal Huitzilac 2022).

It borders to the north with the Tlalpan Delegation of Mexico City, to the east with Tepoztlán, to the south with Cuernavaca, and to the west with Tianguistenco and Ocuilan in the State of Mexico. Two types of climate predominate in the municipality: cold in the northern part (52%) and temperate sub-humid in the remaining area (48%) (Gobierno del Estado de Morelos 2022).

Box 1

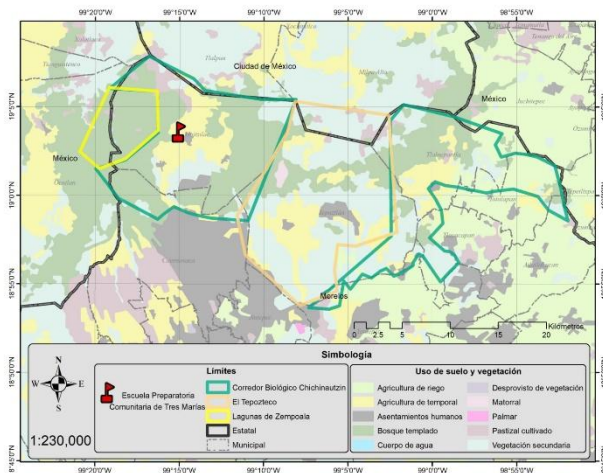


Figure 1

Map of the location of the Tres Marías Community High School

Source: Author's Own Elaboration.

According to the 2020 Population and Housing Census, the municipality has a population of 24,515 inhabitants, representing 1.2% of the state's total population. Of this total, 12,539 are women and 11,976 are men, accounting for 51.1% and 48.9% of the population, respectively. The age groups with the highest concentration of both men and women range from 5 to 24 years old. Overall, 51% of the municipality's population is considered young, meaning they are between 0 and 29 years of age (INEGI, 2020).

It is characterized as a rural environment with strong territorial and community ties. In this setting, the technical programs of Forestry Technician and Sustainable Community Development Technician are offered, addressing the need to train students capable of contributing to sustainable territorial management and developing solutions to the socio-environmental crisis.

This paper presents the results of a climate change perception exercise conducted with students from this high school, as part of an approach that recognizes young people as key actors in the transition toward a more sustainable society. Based on the analysis of these data, the aim is to argue that the students of Tres Marías not only possess knowledge about climate change but also demonstrate dispositions, attitudes, and values that position them as agents of environmental change.

Methodology

The research is based on the application of a 20-question survey administered to a sample of 129 students from the Escuela Preparatoria Comunitaria de Tres Marías, with the aim of identifying their perceptions, knowledge, and attitudes toward climate change. The sample consisted of 89% students between 15 and 20 years old, 62.7% female students, 35.6% male students, and 1.5% who identified with another gender. This also makes it possible to acknowledge the diversity within the student body and its implications for participation practices and environmental education.

The results obtained from the applied instrument not only made it possible to identify the levels of environmental knowledge and perception among the students but also to place them within the broader context of the environment in which they develop as social and educational subjects. The combination of responses regarding the issues that concern them most and their statements about climate change provided a comprehensive understanding of the students' environmental, social, and political imagination.

Educational Purpose and Alignment with the 2030 Agenda

From the perspective of critical pedagogy (Freire, 1970), Education must be a tool for liberation and social transformation. Rather than reproducing knowledge in a "banking" manner, it should foster critical reflection and conscious action. In rural contexts such as Tres Marías, this approach empowers students as actors who understand their reality, question it, and act within it.

Environmental education for sustainability (Leff, 2004; Sauvé, 2005) presented as a transversal, territorial, and transformative pedagogy. It is not merely about teaching environmental topics but about forming ethical individuals committed to socio-environmental justice and capable of envisioning alternatives to the dominant model of development.

Ecological citizenship, as proposed by [Bascopé \(2021\)](#) y [González-Gaudiano \(2009\)](#), advances a vision of citizenship that is critical and environmentally engaged, assuming collective responsibility for the care of common goods. It involves participation in decision-making processes and the exercise of ecological rights and duties that go beyond the notion of responsible consumption.

Meanwhile, the service-learning (SL) approach connects academic training with community engagement. Authors such [Puig, Gijón Casares, Martín García y Rubio Serrano, \(2011\)](#) define it as a methodology that integrates the learning of content and values with the performance of solidarity-based activities aimed at improving the environment. In rural contexts, SL enables students to develop projects that address real problems within their communities while strengthening their identity, autonomy, and professional vocation.

Ultimately, this theoretical framework allows for understanding the students of the Tres Marías community not only as learners of a technical trade but as ecological citizens in training, territorial transformation agents, and key actors in the transition toward more sustainable ways of life.

The educational proposal of the Escuela Preparatoria Comunitaria de Tres Marías aligns directly with the principles of the 2030 Agenda for Sustainable Development, particularly with Target 4.7 of SDG 4, which seeks to ensure that all learners acquire the knowledge and skills needed to promote sustainable development. This includes education for sustainability, human rights, gender equality, the promotion of a culture of peace and global citizenship, as well as the appreciation of cultural and natural diversity.

The institution's mission is to train individuals with analytical and strategic abilities to promote community development through the sustainable use of natural resources. This mission translates into a clear general goal: to educate Forestry Technicians and Sustainable Community Development Technicians with the technical, scientific, and ethical competencies required for the conservation and management of natural resources, guided by a critical, ecological, and socially engaged vision.

From this perspective, the specific objectives of both programs strengthen the link between professional training and the territorial context. In the case of the Forestry Technician, the focus is on comprehensive and sustainable education that addresses regional development needs through technical procedures that enhance production and conservation. The Sustainable Community Development Technician, on the other hand, is oriented toward the design of public policies, participatory projects, and strategies that connect economic development with environmental protection. The educational proposal becomes even more relevant due to the location of this academic unit within the Chichinautzin Biological Corridor and the social composition of its student body, which, as previously mentioned, comes from ejido and communal families. This not only reinforces the pertinence of the curriculum but also turns the school into a natural incubator of community leaders capable of participating in institutional and governmental processes related to sustainable development.

These young people, educated in a context of high biocultural richness and with technical training oriented toward territorial action, have the potential to become environmental promoters with a critical perspective on climate change. Their education enables them to diagnose local problems, communicate sustainable knowledge and practices, participate in the implementation of environmental policies, and lead mitigation and adaptation initiatives both within their communities and in inter-institutional spaces. The articulation between their territorial identity, ethical commitment, and technical training positions them as key agents in the transition toward resilient ways of life in the face of climate change.

Social Concerns and Perception of Climate Change

The results made it possible to identify the levels of environmental knowledge and perception among the students, while also situating them within the broader context of their social and educational environment. The combination of responses regarding the issues that generate the greatest concern with statements related to climate change provided a comprehensive view of their environmental, social, and political imagination.

Firstly, the fact that climate change was identified as the second most concerning issue (58.1%), practically at the same level as violence and war (58.9%), revealed that students do not perceive environmental issues as separate from social ones, but rather as part of a complex network of contemporary threats and challenges (Figure 2). This holistic perspective is consistent with a territorial approach to environmental education, which recognizes that the impacts of climate change are neither abstract nor distant, but are manifested in their communities through water stress, loss of forest cover, and alterations in agricultural cycles.

Box 2

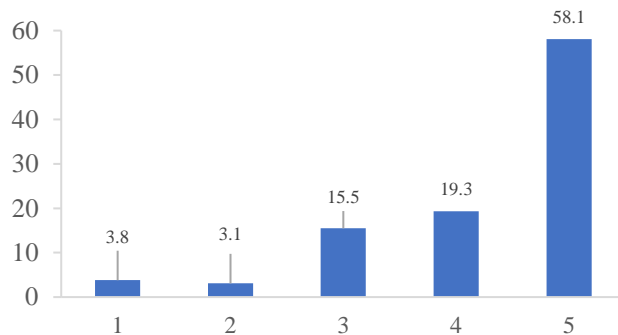


Figure 2

Percentage of students who identify climate change as a concerning issue (scale from “not very concerning” to “very concerning”)

Source: Author's Own Elaboration

When examining other issues identified as priorities, such as crime, overpopulation, poverty, infectious diseases, and unemployment, a panorama of multiple vulnerabilities that shape the lives of rural youth becomes evident. Within this context, climate change is not perceived as an isolated threat but as a factor that can worsen existing conditions of inequality and precarity, making it a legitimate concern from an environmental justice perspective.

On the other hand, as shown in Figure 3, the high levels of agreement with statements such as “Temperatures have changed” (73.6%), “Climate change is caused by human activities” (67.4%), and “It is happening right now” (62.1%) confirmed that the students possess a fairly consolidated level of awareness regarding the reality and causes of the climate phenomenon.

Moreover, the fact that 62.1% consider it a global threat and 51.1% perceive it as a personal or family threat demonstrates significant progress compared to previous studies (such as de Jiménez-Ávila *et al.*, 2014), in which the prevailing perception was that climate change would mainly affect other people or future generations.

Box 3

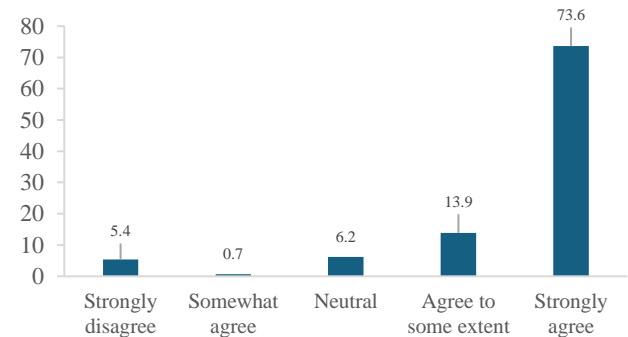


Figure 3

Percentage of students who confirm or deny that the planet's temperatures have changed compared to the previous decade.

Source: Author's Own Elaboration

These data are particularly meaningful within the geographical and cultural context in which the high school is located: a region integrated into the Chichinautzin Biological Corridor, rich in biodiversity and ecosystem functions, yet vulnerable due to its proximity to unregulated urban growth, real estate pressure, and the improper use of land and water. Furthermore, nearly one-third of the student body comes from communal or ejido families, which reinforces their direct connection to natural resources, forests, and the territory (Secretaría de Desarrollo Sustentable. Dirección General de Áreas Naturales Protegidas 2024).

In this sense, the students are not only receiving technical training in environmental subjects but also living daily in territories where climate change has real and visible effects, such as reduced runoff, increased forest fires, and greater water stress. This gives them dual conditions: they are both a vulnerable population and potential promoters of community resilience and adaptation.

Therefore, these results confirm the relevance of the school's pedagogical approach, as well as the opportunity to strengthen its role as a training space for environmental promoters with critical awareness, territorial sensitivity, and the capacity for civic engagement, aligned with the principles of the 2030 Agenda and sustainable development with social justice.

Perception of Climate Change and Willingness to Act

The results obtained from the applied instrument provided key information to assess the potential role of students as agents of change in the face of climate change. When asked how much they believe that climate change threatens their personal health and safety, 38.7% of students rated this threat as high. Although this figure does not represent a majority, it is significant because it shows that more than one-third of the student body recognizes a direct link between the global climate phenomenon and their everyday lives, constituting a first step toward the awakening of situated environmental awareness. This perception of risk is fundamental in terms of environmental education, since various studies (Fernández, DC, Gómez-Gonçalves, A., y Sánchez-Barbero, B. 2023; Akerlof *et al.*, 2010) have demonstrated that personal identification with the impacts of climate change increases the likelihood of commitment and action. In this case, the data suggests that at least a significant portion of the students already internalize climate change as a concrete and present threat, rather than a distant or abstract phenomenon.

In line with this perception, students were asked how likely they would be to recommend that family members or friends promote activities that reduce global warming or encourage more sustainable lifestyles. 27.9% indicated that they would probably do so, which reflects an initial willingness to exert social influence within their immediate environment, although still with some uncertainty or hesitation that could be addressed through the strengthening of their environmental education and communication skills. Both responses reveal that the students of the Escuela Preparatoria Comunitaria de Tres Marías are beginning to position themselves as subjects capable of acting, especially when climate change is perceived as a threat that can affect their health, safety, or community.

This connection between risk perception and willingness to promote sustainable actions can become a catalyst for transformative educational processes if accompanied by participatory methodologies, community projects, and deliberate spaces.

Thus, although the percentages are not yet a majority, the results allow us to affirm that there is a significant core of students with active environmental awareness and a disposition to influence their surroundings, which supports the relevance of their technical training and their potential as environmental promoters within the territorial context in which they live and study.

Global Climate Knowledge and Gaps in the Understanding of National Policies.

The results in this regard showed a high general awareness of the existence of climate change. As illustrated in Figure 4, 93.3% of students stated that global temperatures have increased over the past decade due to human activities. Likewise, 64% reported being aware of global initiatives or policies aimed at addressing the issue, suggesting that young people are exposed to international narratives about the problem. However, this awareness did not translate equally to the national level: 71% of respondents said they were not familiar with Mexico's environmental policies, revealing a significant gap between the global climate discourse and the local institutional framework's appropriation.

Box 4

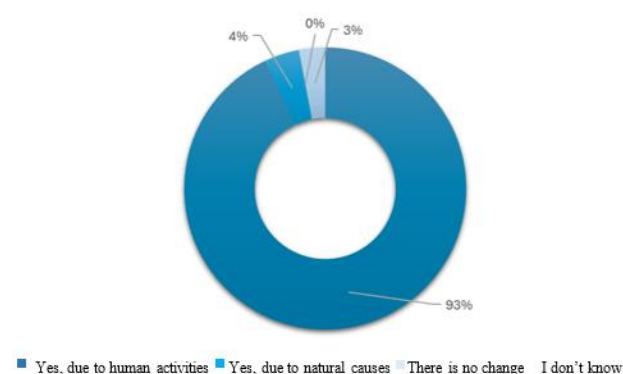


Figure 4

Students' perception regarding the causes of the planet's temperature increases over the past decade.

Source: Author's own elaboration

This gap was also reflected in the students' self-assessment of specific knowledge. Although most students reported having a "slightly broad" understanding of topics such as aerosols (32.5%), greenhouse gases (31%), and ocean currents (26.3%), only 29.4% stated that they had an extensive understanding of the phenomenon of deforestation, and just 26.3% claimed to have a "moderately broad" knowledge of climate change in general.

It is noteworthy that the El Niño phenomenon is largely unknown among students, 34.8% stated "I know nothing about it", despite its direct relevance to the region's climatic variability (Figure 5). These data suggest that, although there is environmental awareness, a deeper and more contextualized technical understanding is still lacking, representing both a challenge and an opportunity to strengthen the educational dimension of the technical programs offered at high school.

Box 5



Figure 5

Students' knowledge scale regarding the El Niño phenomenon.

Source: Author's own elaboration

Media and Trust in Information about Climate Change: A Comparative Reading

In the study conducted by Jiménez-Ávila, Sánchez Salina y Ortiz-Hernández (2014), it was observed that traditional media, especially television and newspapers, played a significant role in shaping the perception of climate change among upper secondary students. In contrast, the current results show a notable shift in the channels through which students access climate-related information. While television (13.5%) and school/university (13.5%) still maintain some presence, it is now the Internet (14%) where students most frequently hear about climate change (Figure 6).

This transition reflects a transformation in young people's information consumption habits, as they now rely primarily on digital platforms, which are more fragmented and constantly updated.

Box 6

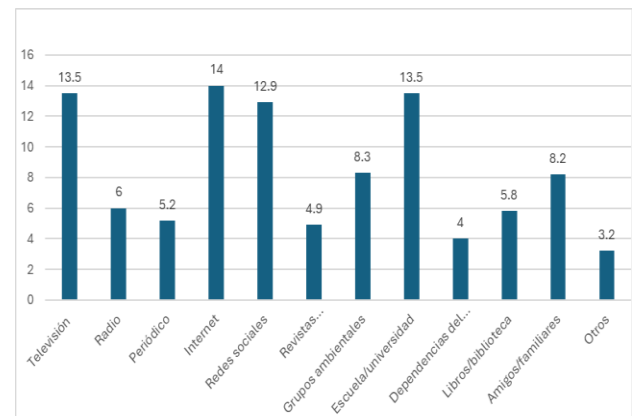


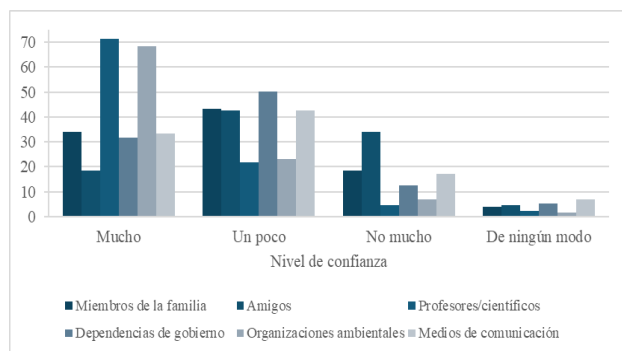
Figure 6

Platform through which students obtain information about climate change

Source: Author's Own Elaboration

However, this shift toward digital media also appears to be accompanied by skepticism toward non-specialized sources. When asked about their level of trust in different sources of information on climate change, as shown in Figure 7, students expressed greater confidence in teachers and scientists (71.3%) and environmental organizations (68.2%), while assigning lower trust to mass media (42.6%), friends (42.6%), and government agencies (50.3%).

This finding reveals an interesting paradox: although the Internet is the main channel of exposure, it is not necessarily regarded as a reliable source. This can be interpreted as a sign of distrust toward the quality and accuracy of information in the digital environment, while academic and scientific expertise is valued as a guarantee of credibility.

Box 7**Figure 7**

Trustworthiness of information related to climate change
 Source: Author's Own Elaboration

Moreover, it is revealing that previously more frequently consulted media—such as radio (6%), books/libraries (5.8%), newspapers (5.2%), and academic journals (4.9%)—now play only a marginal role in the socialization of environmental knowledge. This decline may be due to their limited accessibility, less interactive formats, or lack of immediate updates compared with new digital platforms.

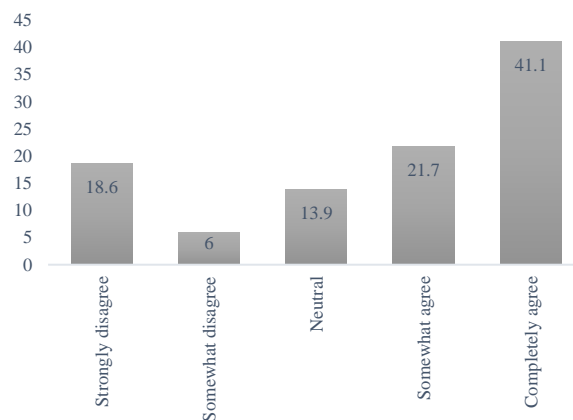
Taken together, these results suggest that environmental education should not rely solely on media exposure but rather be strengthened within the school setting by integrating critical pedagogical strategies that teach students to analyze, validate, and contrast the information they receive, especially in digital environments. They also highlight the need to enhance the role of teachers as key agents in developing climate awareness, given the high level of trust students place in them as reliable sources of knowledge. Finally, when compared to the 2014 study, there is a clear shift from traditional channels to digital platforms, without a corresponding increase in trust, pointing to the need for new educational strategies that integrate media, content, and critical thinking regarding climate change.

Perceptions of Responsibility and Individual and Collective Commitment toward Climate Change

The results reflected a shared vision of responsibility for climate change, in which students identified both institutions and individuals as accountable actors. 56.5% considered that local governments (state and municipal) should bear the primary responsibility for addressing this issue, followed closely by individuals (55.1%) and environmental organizations (54.2%).

This finding indicates a conception of climate action as a distributed task, with a strong emphasis on local levels—both institutional and civic. Less confidence was placed in national governments (33.3%) and international organizations (36.4%), suggesting a critical distance toward large political structures, perhaps influenced by the perception of limited action or effectiveness.

Regarding attitudes toward individual actions, Figure 8 shows that 41.1% of students completely agreed that each person can help reduce the effects of climate change, indicating an internalization of personal agency. Meanwhile, 34.1% strongly supported mandatory energy consumption reduction if it contributes to mitigating global warming, and 32.5% expressed a commitment to actively participate in environmental initiatives, reflecting a clear inclination toward ecological activism.

Box 8**Figure 8**

Responsibility for each person in actions related to climate change

Source: Author's Own Elaboration

In contrast, only 25.5% of students considered climate change to be inevitable due to modern society, and 40.3% strongly rejected the idea that it is an unmodifiable natural phenomenon, demonstrating a level of scientific literacy that distinguishes between natural and anthropogenic causes. Likewise, 49.6% completely disagreed with the statement that cutting down trees to build infrastructure is not serious, while similar percentages rejected both the minimization of climate change by the media (42.6%) and the notion that there are more important issues (41.1%).

These positions were reinforced by the predominant environmental motivations behind their daily behavior. Activities such as planting trees (86.1%), recycling (79.8%), and participating in campaigns (79.1%) are mainly carried out for environmental reasons, indicating a strong pro-environmental orientation in their personal decisions. Although some practices are also linked to economic savings, such as using public transportation, ecological commitment remains the primary motivation for most actions.

Regarding the perception of actions by different actors, students expressed, as shown in Figure 9, greater confidence in environmental groups (74.4%) and international organizations (51.9%) as entities taking concrete measures. However, they identified industries (55.1%) and citizens themselves (49.6%) as actors not taking sufficient initiatives, while national and regional governments were perceived as involved “to some extent” (44.9% in both cases). This reinforces the idea that, although environmental awareness is growing among young people, there is a perceived gap between that awareness and the broader institutional and civic action.

Box 9

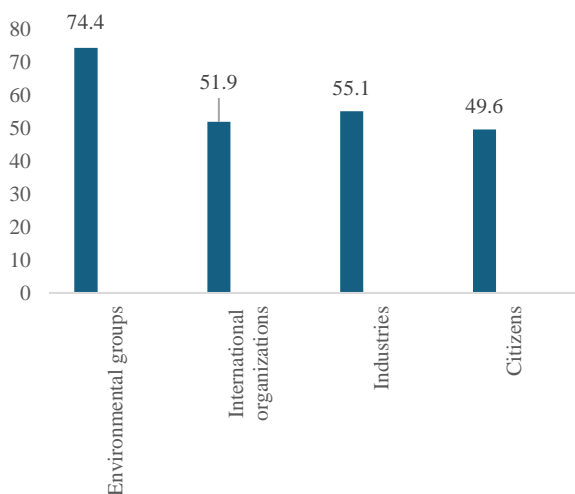


Figure 9

Students' trust in actions related to climate change

Source: Author's Own Elaboration

Finally, the open-ended comments reinforced the need for more information, awareness, and environmental education: 17.8% proposed more educational campaigns, 12.4% called for waste and pollution reduction, and 9.3% directly mentioned the need for greater awareness and knowledge about the effects of climate change.

Taken together with the rest of the analysis, these responses confirm that students not only have a clear understanding of the issue but also a willingness to act, even while recognizing significant structural and social barriers to effective transformation.

Overall, the students of the Escuela Preparatoria Comunitaria de Tres Marías demonstrated a critical, informed, and committed stance toward climate change, identifying multiple levels of responsibility while emphasizing the need to strengthen local, community, and institutional action. This perception further supports their potential as agents of environmental change, capable not only of modifying individual habits but also of influencing their territories through a logic of socio-ecological co-responsibility.

Conclusions

Regarding the general hypothesis of the study, which proposed that the students of the Escuela Preparatoria Comunitaria de Tres Marías have the potential to become environmental change agents in the face of climate change, given their contextualized technical training, pro-environmental attitudes, and critical awareness of their surroundings, the findings support this assumption.

A very high percentage of students (93.3%) recognized that global temperature has increased in the last decade and attributed it primarily to human activities. This confirms an adequate level of basic environmental literacy, validating one of the central premises of the hypothesis.

A significant portion of the student body (41.1%) completely agreed that each person can contribute to reducing the effects of climate change, while a similar percentage expressed willingness to act through responsible consumption and participation in campaigns. This supports the idea that students not only possess knowledge but also demonstrate attitudes consistently with an active role as environmental promoters. Although students reported being familiar with global climate policies (64%), 71% stated that they do not know Mexico's environmental policies, suggesting an informational gap that may limit their participation in government programs.

This gap represents an educational opportunity rather than a contradiction of the hypothesis, reinforcing the importance of strengthening the curriculum.

The high level of trust placed in teachers and scientific organizations (over 70%) confirms the school's key role as a mediator between technical knowledge and community action. This demonstrates that the educational environment is a strategic channel for empowering youth as agents of change.

In activities such as recycling, tree planting, and energy saving, the main motivations expressed by students are environmental rather than economic. This finding is fundamental to conclude that there is a student profile with values aligned with sustainability, which is an essential component of an environmental change agent.

Although students acknowledged the responsibility of local and national governments, many perceived that citizens and industries are not acting sufficiently. This diagnosis reveals a critical stance toward social actors and reinforces the notion of youth agencies: students are not waiting for external solutions; they see themselves as part of the solution.

The students' belonging to ejido communities within the Chichinautzin Biological Corridor and their technical forestry or community-oriented training provide them with a privileged framework to apply their knowledge, join environmental programs, and assume territorial leadership.

The set of results confirms the study's hypothesis: students of the Escuela Preparatoria Comunitaria de Tres Marías possess foundational knowledge, pro-environmental attitudes, a willingness to act, and strong territorial roots. All these elements position them as environmental change agents with the potential to influence their communities through technical, educational, and participatory actions in response to climate change.

Compared with the 2014 study, it was found that although students at that time were aware of climate change, their knowledge was often fragmented and ambiguous.

In contrast, in the current study, over 90% identified the temperature increase as a real phenomenon caused by human activity, and more than 60% fully agreed with key statements such as "climate change is happening now" and "it represents a serious global and personal threat." This shows a significant improvement in conceptual understanding of the phenomenon.

While in 2014 awareness did not necessarily translate into action, in 2025 a higher percentage of students expressed willingness to participate in environmental activities, change their habits, or promote awareness among family and friends, suggesting a shift from passive perception to active agency.

In 2014, students had moderate trust in the media and government as sources of environmental information. In contrast, the current study shows greater skepticism toward these actors and a transfer of trust to teachers and scientists. This may indicate a strengthening of critical awareness as well as a more questioning sociopolitical environment.

Despite the overall progress, there remains a lack of knowledge about national environmental policies: more than 70% of students reported not knowing them, an issue that was already present in 2014. This reflects a continuing structural problem in how such policies are communicated and taught within the educational system.

In 2014, television was the main source of information; by 2025, while it remains present, the Internet and social media have gained greater importance, though they still inspire low trust as sources of information. This presents new challenges for environmental media education.

In comparison with 2014, the current findings show that the level of awareness, understanding, and willingness to act on climate change has substantially improved among upper secondary students in Morelos, particularly within the technical and territorial context of Tres Marías. However, significant gaps remain in knowledge about national environmental policies and trust toward certain institutional actors, highlighting the need to reinforce comprehensive educational strategies with territorial, political, and participatory approaches.

This progress in student perception and agency strengthens the role of the Escuela Preparatoria Comunitaria de Tres Marías as a seedbed of eco-citizens capable of influencing local and regional contexts in the fight against climate change.

Declarations

Conflicts of Interest

The authors declare no conflicts of interest. There are no known financial or personal relationships that could have influenced the results and conclusions presented in this article.

Authors' Contributions

Silveyra-Rosales, Mariana Teresa: Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft.

Sandoval-Manrique, Juan Carlos: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Project administration, Resources.

Machorro-Onofre, Ana Rosa: Conceptualization, Data curation, Investigation, Methodology.

Availability of data and materials

All data obtained in this research are available.

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Abbreviations

CC – Climate Change

ANP – Protected Natural Area

UAEM – Universidad Autónoma del Estado de Morelos

INEGI – National Institute of Statistics and Geography

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Prototype of a web application for the promotion of tourism in the Huasteca Hidalguense

Prototipo de aplicación web para el fomento del turismo en la Huasteca Hidalguense

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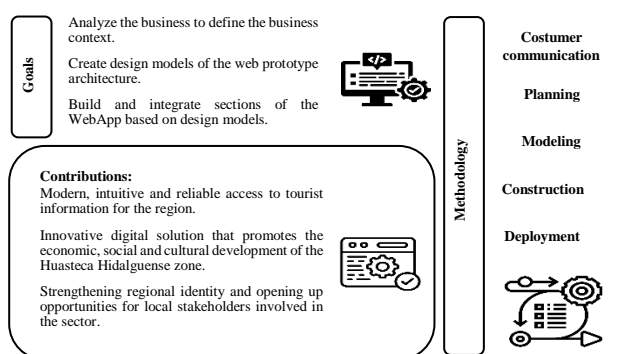
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Abstract

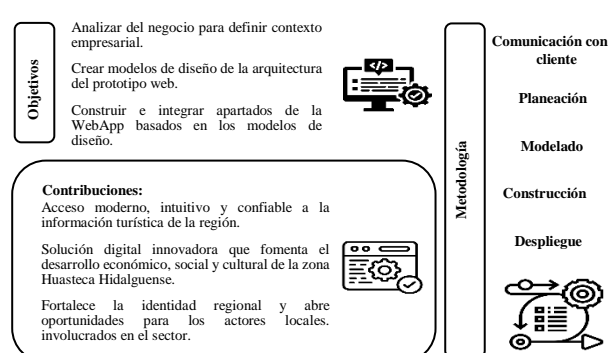
This research focuses on the design and development of a prototype web application aimed at boosting tourism in the Huasteca Hidalguense region; it integrates key information on cultural, natural, and gastronomic attractions, while also promoting local services and products for effective dissemination. The Iweb methodology was employed, structuring the process into sequential phases: customer communication, planning, modeling, construction, and deployment of the platform. The result is a functional web application that centralizes tourist data, incorporates interactive maps, and facilitates the visibility of regional offerings. This initiative addresses a current problem by offering an innovative digital solution that fosters economic, social, and cultural development in the area. By providing modern, intuitive, and reliable access to tourist information, the prototype strengthens regional identity and opens opportunities for local stakeholders involved in the sector, contributing to the growth of the Huasteca Hidalguense.



Prototype, Tourism, Huasteca.

Resumen

Esta investigación se enfoca en el diseño y desarrollo de un prototipo de aplicación web destinada a impulsar el turismo en la región de la Huasteca Hidalguense; integra información clave sobre atractivos culturales, naturales y gastronómicos, además de promover servicios y productos locales para su difusión efectiva. Se empleó la metodología Iweb, que estructuró el proceso en fases secuenciales: comunicación con el cliente, planeación, modelado, construcción y despliegue de la plataforma. El resultado es una aplicación web funcional que centraliza datos turísticos, incorpora mapas interactivos y facilita la visibilidad de ofertas regionales. Esta iniciativa responde a una problemática actual, ofreciendo una solución digital innovadora que fomenta el desarrollo económico, social y cultural de la zona. Al proporcionar acceso moderno, intuitivo y confiable a la información turística, el prototipo fortalece la identidad regional y abre oportunidades para los actores locales involucrados en el sector, contribuyendo al crecimiento de la Huasteca Hidalguense.



Prototipo, Turismo, Huasteca

Area: Development of strategic leading-edge technologies and open innovation for social transformation

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Introduction

Nowadays, the internet has become the main means of searching for information about destinations, making reservations and planning trips, because the accessibility, speed and reach of the network allow users to consult aspects such as transport, accommodation, gastronomy or recreational activities from anywhere.

A tourism website allows all relevant information about a region to be centralised, such as places of interest, accommodation, cultural activities, gastronomy and typical products. It also offers users the possibility of interacting through queries, online purchases and advance bookings, which improves their travel experience and contributes to local economic growth (Chung, et al., 2015).

Today, personalising the visitor experience through interactive interfaces, relevant content and intuitive navigation has become one of the main demands of digital tourism. The main value of this research is to offer tourists a comprehensive and dynamic web portal that allows them to consult organised information on the different tourist attractions in the Huasteca Hidalguense region, including hotels, restaurants, typical cuisine, traditional events and festivities, as well as ecotourism areas, recreational activities and the sale of handicrafts.

The information available for consultation includes: names of destinations, descriptions, images, user comments, information on products and services, events, reviews and geographical data on tourist sites.

Access to this information by domestic and international tourists will help to boost the flow of visitors and tourism in the area, which has been reduced due to the fact that the region does not have a digital platform that offers all the tourist sites of interest in the region, handicraft products, accommodation services, cultural events and festivities, gastronomy, among many others, to facilitate the stay of visitors and benefit both the best-known municipalities and less explored communities.

Together, all these tools make it possible to build an interactive platform that can be adapted to the needs of tourism promotion and artisan marketing in the Huasteca Hidalguense region.

It is hoped that the impact of this platform will not be limited to the technological sphere, but will also be reflected in the strengthening of local economies, the preservation of regional cultural identity and the consolidation of the Huasteca Hidalguense as a competitive tourist destination at the national and international level. Technology thus becomes a bridge between the cultural wealth of the peoples and the interest of global travellers.

Problem.

Despite the natural, geographical, artisanal, cultural, and gastronomic wealth that characterises the Huasteca Hidalguense, the region faces a significant limitation in the promotion and dissemination of its local tourist attractions due to the absence of a centralised and accessible digital platform that integrates up-to-date and reliable information for domestic and foreign visitors.

This shortcoming makes it difficult for tourists to plan their trips and safely access sites of interest and ecotourism, services, local products, festivities, and cultural activities, which negatively impacts the tourist experience, visibility, and economy of the host communities.

This situation also limits the possibility of organising responsible tours and experiences that avoid crowds and promote respect and preservation of the natural and cultural environment.

Likewise, the absence of a modern, accessible and up-to-date technological tool restricts opportunities for sustainable economic and social development for local service providers, as they do not have a digital space to promote their products, offer authentic experiences or market handicrafts and typical cuisine.

Similarly, it prevents visitors from having reliable information on routes, service directories, and options for safely purchasing handicrafts and typical products, thereby restricting the dissemination and responsible use of the area's cultural and natural resources.

Justification

The Huasteca Hidalguense region has enormous tourism potential due to its biocultural diversity, unique ecosystems (medium-sized forests, rivers, waterfalls, and caves), its archaeological wealth and its intangible heritage, such as the Huasteca tradition, the dance of the acrobats, the music of the Huasteca son and a nationally recognised gastronomy (Hidalgo Ministry of Tourism, 2024).

According to the UNWTO World Tourism Barometer (UNWTO, 2023), more than 80% of international travellers use the internet as their main source for planning their trips, prioritising platforms that provide up-to-date information, real reviews and georeferenced tools. In Mexico, 29% of total online purchases are related to tourism (AMIPCI, 2020), highlighting the need for responsive, easy-to-navigate web applications to serve and respond to more than 30 million tourists.

However, in the Huasteca Hidalguense region, there is currently no official or private portal that centrally integrates and permanently updates the complete tourist offer of the eight municipalities that comprise it (Huejutla de Reyes, San Felipe Orizatlán, Jaltocán, Atlapexco, Huautla, Yahualica, Xochiatipan, and Huazalingo), according to an assessment carried out by the Hidalgo State Tourism Secretariat (Secretaría de Turismo de Hidalgo, 2023).

Given the problem identified, there is an urgent need to develop a prototype interactive web application that acts as a link between tourists and local communities, providing centralised tourist information, up-to-date digital tools and promotional spaces for products and services, thus contributing to the strengthening of the regional economy and the promotion of safe, responsible, sustainable and inclusive tourism in the Huasteca Hidalguense.

This platform will help to activate the regional economy by offering promotional spaces for local businesses, promoting the marketing of typical products through a digital marketplace, and providing modern tools such as interactive tourist guides, dynamic maps, and educational content on Huasteco cultural heritage.

It also aims to reduce the region's tourism digital divide, aligning itself with the objectives of the Hidalgo State Tourism Sector Programme 2021-2027 and the National Sustainable Tourism Strategy 2020-2024 (SECTUR, 2020).

These actions will facilitate the economic inclusion of micro and small service providers (artisans, local guides, family restaurants, and ecotourism operators) through a free and permanent online promotion and marketing space, as recommended by studies on the collaborative economy applied to rural tourism (Richards, 2018).

In addition, the project lays the groundwork for future technological and tourism initiatives in the region, facilitating digital training for the communities involved and promoting an inclusive, responsible, and sustainable tourism model that favours both the preservation of heritage and the well-being of current and future generations.

Objective

To develop a prototype web application for the promotion of tourism in the Huasteca Hidalguense, through the analysis of the organisational context, the identification of participants and the integration of technology, with the aim of centralising tourist information in the region, boosting the local economy and encouraging responsible, sustainable and inclusive tourism.

Theoretical foundations

The Huasteca Hidalguense as a biocultural tourist destination

The Huasteca Hidalguense region, located in the north of the state of Hidalgo, Mexico, represents a mosaic of natural biodiversity and cultural wealth that positions it as a tourist destination with high potential for sustainable development.

This area, which covers eight municipalities in the state, is characterised by its humid tropical ecosystems, mighty rivers such as the Pánuco and impressive waterfalls, together with a Nahuatl indigenous heritage that permeates its traditions, gastronomy and crafts (León-Paniagua, et al., 2010). However, its effective promotion depends on digital tools that integrate these elements, allowing for accessible and attractive dissemination.

In this context, web applications are emerging as key platforms for centralising tourist information, encouraging interaction and supporting the local economy, in line with the demands of an increasingly digitalised and responsible tourism industry.

The evolution of tourism towards sustainability and authentic experiences.

Tourism, understood as the temporary movement of people outside their usual environment for leisure, business or cultural purposes ([Organización Mundial del Turismo, 2023](#)), has evolved towards forms that prioritise sustainability and cultural immersion.

In regions such as the Huasteca Hidalguense, where biodiversity includes medium-sized forests with endemic species and intangible heritage such as Huasteco music or zacahuil (a traditional giant tamale), cultural and ecotourism can generate income while preserving these resources ([Vázquez Solís, et al., 2024](#)).

Studies highlight that 70% of Millennial and Generation Z tourists seek authentic experiences that combine nature and culture, driving the need for digital tools that facilitate this connection ([García-Roselló, et al., 2019](#)).

Web applications for tourism promotion

Web applications for tourism promotion are defined as online platforms that integrate multimedia content, interactive features, and databases to promote a destination's attractions.

These tools centralise information on cultural sites (such as the Cristo Rey Cathedral built in 1541), natural sites (Tetixtil waterfalls), and gastronomic sites (Huasteca enchilada festivals). They also allow users to book local services and provide feedback, improving the visibility of indigenous communities ([Guzmán-Pérez & Sánchez-Cañizares, 2012](#)).

Their value lies in their capacity for personalisation; using recommendation algorithms, they adapt routes to individual preferences, reducing tourist overload in sensitive areas and promoting responsible tourism that respects environmental carrying capacity.

Interactive maps and geographic information systems in tourism.

An indispensable component in these applications is the interactive map, which combines geographic information systems (GIS) with web interfaces to offer dynamic navigation. These maps allow users to zoom in, activate thematic layers (e.g., ecological routes or Huasteca archaeological sites) and consult real-time data, such as cultural events or weather alerts ([Del Río-Arca, 2015](#)).

Academic research highlights their importance in tourism, as they facilitate spatial orientation, enrich the educational experience, and support sustainable planning, with studies in Colombia and Spain showing a 40% increase in visitor satisfaction when using interactive maps ([Valero, 2013](#)).

In the context of the Huasteca, where mountainous topography and rivers complicate mobility, these georeferenced elements can integrate biodiversity data (such as sightings of endemic birds) with cultural narratives, promoting ethno-tourism that values the biocultural memory of Nahua communities ([Gutiérrez-Santillán, 2013](#)).

Iweb methodology for the development of tourism web applications

The Web Engineering (Iweb) methodology, proposed as a systematic approach to web application development, is particularly suitable for tourism projects, as it emphasises iteration based on feedback from local stakeholders, ensuring that the platform reflects real needs, such as the inclusion of indigenous languages or mobile accessibility.

Unlike traditional software engineering approaches, Iweb incorporates principles of web usability and scalability, allowing for continuous updates to maintain relevance in a dynamic sector ([Pressman, 2010](#)). Its application in similar contexts has been shown to reduce development times by 25% while improving interactivity ([Sánchez López, n.d.](#)).

Methodology

The Iweb methodology was used for the design and development of the web application prototype for this research.

This is a systematic, structured and sequential model specifically geared towards the development of web applications, which allows for rigorous control of the project while facilitating the active participation of the client and end users throughout the process. In addition, it integrates principles of traditional software engineering with considerations unique to the web environment, such as usability, scalability, and end-user interaction.

This methodology consists of five clearly defined phases: Communication with the client, Planning, Modelling, Construction, and Deployment (Pressman, 2005):

Box 1

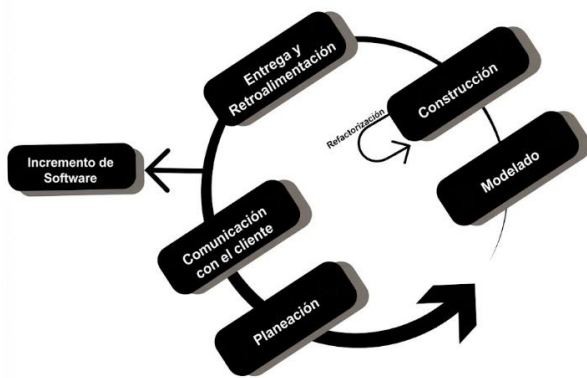


Figure 1

Iweb Methodology

The communication stage focuses on continuous interaction with stakeholders to identify and document preliminary project requirements. It includes meetings, interviews, and end-user needs analysis, with the aim of aligning customer expectations with the technical capabilities of the web application, thus laying the foundation for development focused on user satisfaction.

Planning involves drawing up a precise schedule or project plan. Here, tasks and a calendar of deadlines are defined for the period (weeks) projected for the development of the project.

Modelling encompasses the creation of abstract representations of the system, including architecture, navigation, and user interface diagrams. The overall structure of the application, interaction flows and initial prototypes are defined, with an emphasis on web usability and cross-platform compatibility, in order to anticipate possible implementation problems.

During construction, the application is implemented, integrating web development tools to produce dynamic and static pages. This phase combines architectural design with actual coding, associating navigation and interface elements to generate a functional prototype that responds to the previous models.

The deployment stage involves publishing the application in an operational environment with real users, including an evaluation period. Feedback is presented to the Iweb team and the increment is modified as required.

Development

The initial phase of communication with the client focused on establishing a permanent channel of dialogue with the main stakeholders: staff of the Ministry of Tourism of the municipality of Huejutla de Reyes, Hidalgo; staff of the College of Architects and Civil Engineers of La Huasteca A.C.; local tourism service providers (food and accommodation); artisans; tour guides, and representatives of indigenous communities in the Huasteca Hidalguense region. These meetings provided insight into local dynamics, including the most relevant aspects to be integrated into the web platform.

Among the needs identified were the lack of a centralised tourist information site, the low digital visibility of local products and services, the need for geolocation to facilitate access to tourist destinations, and the dynamic updating of content. The opportunity to strengthen regional identity and attract more visitors by having a modern and interactive tool was also identified.

As a result of this stage, the Software Requirements Specification (SRS) document was drawn up, which included the definition of functions such as the display of attractions, search by municipality, interactive map, festivities, crafts section, and services directory.

Once the requirements were validated, the general schedule and the assignment of tasks and times were defined as part of the planning process. A work plan was established with deliverables by phase and specific dates; a 14-week schedule was set, distributed across different key stages, allowing for the efficient organisation of activities.

Box 2

Table 1
Project planning

#	Activity	Prog/ Rev	Weeks													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Communication	P	█	█												
		R														
2	Planning	P			█	█										
		R														
3	Modelling	P					█	█	█							
		R														
4	Construction	P							█	█	█	█	█	█		
		R														
5	Deployment	P													█	
		R														

Own Elaboration

For the prototype modelling, the information architecture and user interface designs were created. Visual prototypes of the system were presented in the form of wireframes, showing the layout and organisation of the elements on each screen, without applying definitive styles or final graphic design; these prototypes allow the structure and navigation flow to be visualised prior to development.

The main entities were defined: ecotourism, festivities, gastronomy, crafts, and accommodation. Interactive prototypes were also designed for the key screens: home page, detailed attraction information, interactive map with thematic layers, and business directory section.

Box 3



Figure 2
Wireframe of the Ecoturismo section

All designs were validated in a second round of feedback with stakeholders to ensure usability and accessibility on mobile devices. During the construction phase, the actual prototype code was implemented. The responsive frontend was developed with Vue.js and Bootstrap 5, ensuring compatibility with mobile and desktop browsers.

Node.js and Express were used in the backend, and RESTful API routes were created for content management. In addition, a MongoDB database was used and the Google Maps API was integrated with custom markers, clusters and thematic layers (nature, culture, gastronomy) for the interactive layer.

The database was populated with initial information on 6 tourist attractions, 8 municipalities, 22 artisans, and 28 service providers, obtained from initial interviews and direct collaboration with the staff of the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (Association of Architects and Civil Engineers of La Huasteca), who, through their active participation, provided suggestions and recommendations for the choice of colour palette and design elements, as well as for the organisational and structural architecture of the portal.

Box 4



Figure 3
Home screen of the web portal

Box 5

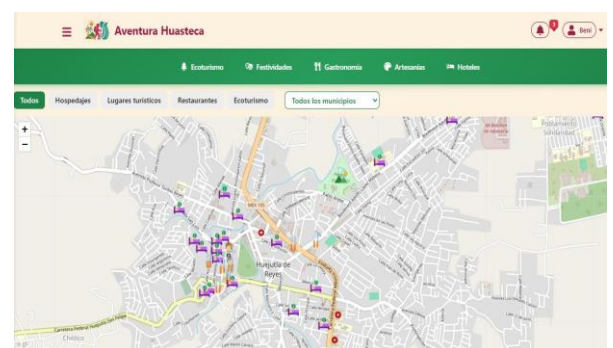


Figure 4
Interactive map

As a security measure, basic content moderation and optimised image loading mechanisms were implemented to filter the content of the information published and reduce loading times.

Box 6

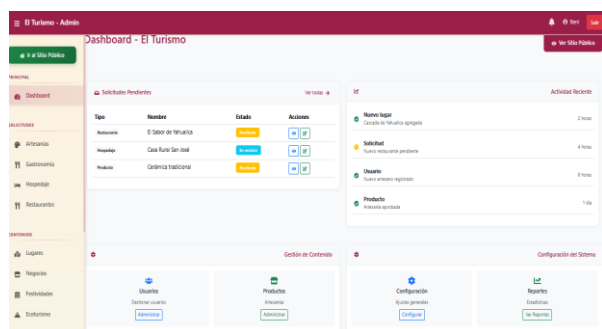


Figure 5

Review of applications for publication

Vercel was selected as the deployment service due to its native compatibility with modern technologies such as React and its support for continuous deployments connected to Git repositories. The ease of integration with full stack projects (Frontend in React and Backend in Node.js) also influenced this choice.

The backend was implemented using Node.js and MongoDB, with the database hosted on an external service (such as MongoDB Atlas), ensuring reliable and scalable storage for tourist information.

The backend was implemented using Node.js and MongoDB, with the database hosted on an external service (such as MongoDB Atlas), ensuring reliable and scalable storage for tourist, gastronomic, and cultural information.

The necessary environment variables (URIs, API keys, port configuration, and protected routes) were configured for both the frontend and backend. The operating environment was tested on different browsers and devices to ensure a consistent user experience.

Functionality, compatibility, and performance tests were conducted on different devices and connection speeds, including 3G/4G mobile networks common in the Huasteca region.

Box 7

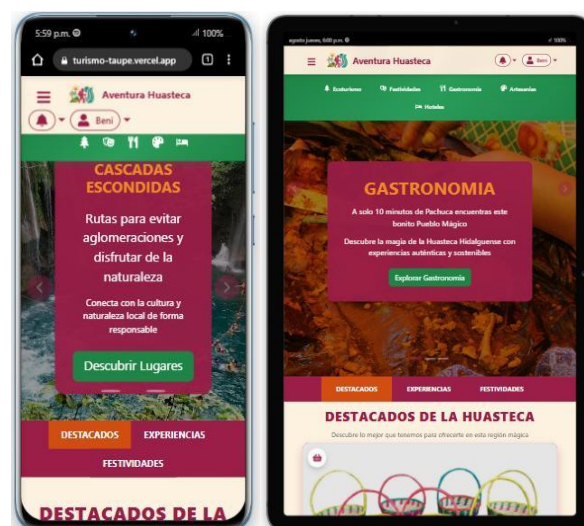


Figure 6

Mobile device testing

The prototype was made available to end users to interact with the different sections of the web portal. At the same time, active tests were carried out on the publication forms and on the interaction with the dynamic maps integrated through the Leaflet library, which allowed simulating the real behaviour of users such as artisans or hosts who wish to publish their services or products on the platform.

First, the user must submit a request for publication, which must be reviewed for security purposes by the website administrator.

Box 8

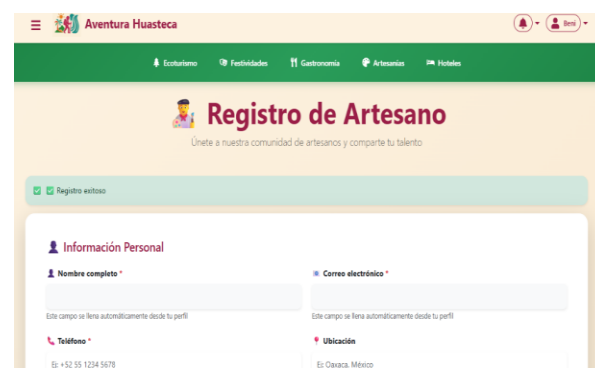
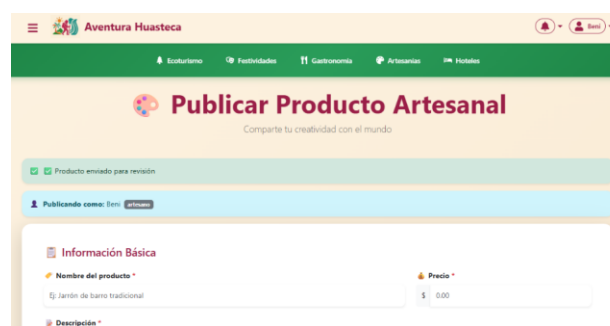


Figure 7

Test for registering as a craftsman

The next step is review by the administrator to ensure that the publication does not contain offensive or illegal content.

Box 9**Figure 8**

Test for review by the administrator

Finally, once the information in the publication request has been reviewed, it is validated and approved for disclosure on the web platform.

Box 10**Figure 9**

Test for administrator approval

This process aims to validate the correct technical functioning of the system and evaluate the usability of the interface, the comprehensibility of the forms, and the navigability of the interactive map.

Finally, technical documentation and an administration manual were generated so that non-technical staff can update content in the future. The strict application of the Iweb methodology made it possible to keep the project within the established deadlines, effectively incorporate the real needs of users, and obtain a functional, intuitive prototype focused on the tourist and cultural characteristics of the Huasteca Hidalguense region.

Results

The development of the prototype web application for the promotion of tourism in the Huasteca Hidalguense region made it possible to meet the objectives set at the beginning of the project.

During the work process, a functional platform was built that includes a tourist directory with information on accommodation, festivities, gastronomy and handicrafts, an interactive map implemented with the Leaflet tool to show the location of points of interest, and a publication system so that artisans, hosts and chefs can publicise their services and products.

This result responds to the problem detected in the Huasteca Hidalguense region, where there was no centralised digital platform for promoting tourist attractions. Now, thanks to this tool, both visitors and service providers can access up-to-date information more easily, which contributes to the promotion of responsible tourism and boosts the local economy.

As for the first objective, which consists of analysing the business to define the business context, both documentary and field research was carried out. Interviews were conducted with stakeholders, which made it possible to define profiles within the system, such as administrators, artisans, hosts, restaurants and tourists, each with specific functions.

Having this structure in place from the outset facilitated the development stage because it allowed us to define everything from the design to the operation of the platform for each type of user.

For the objective of creating design models for the web prototype architecture, tools such as Balsamiq were used to develop the first sketches and wireframes, which allowed us to define the appearance of the web portal, the location of the different components (buttons, images, and texts), and how the user would move between the different sections.

These designs were implemented with Bootstrap, ensuring that the final result was as requested and planned by the end users, which also helped to make the platform more intuitive and user-friendly.

The objective defined for building and integrating the sections of the application was also achieved. Sections were created dedicated to gastronomy, where each dish includes its description, ingredients, history, and location.

To accommodation, where you can see its exact location, photos, and contact details; and to crafts, with a catalogue presenting the available products. In addition, the interactive map allows you to visually locate the different tourist spots, making it easier for visitors to plan their itinerary.

In terms of the tools used, React.js was very useful for creating a dynamic interface, Node.js and Express allowed for efficient handling of server requests, MongoDB adapted very well to the variety of data handled, Leaflet was lightweight and easy to integrate for the map, Bootstrap helped maintain a clean and adaptable design, and Vercel made deployment fast and stable.

In summary, the project fulfils the objective of creating a prototype web application that centralises tourist information on the Huasteca Hidalguense and facilitates the promotion of local products and services.

This work represents a first step towards giving the region a greater digital presence and enabling it to make better use of its tourist, cultural and gastronomic attractions, contributing to the economic and social development of the communities involved.

Conclusions

The development of the prototype web application for the promotion of tourism in the Huasteca Hidalguense region highlighted the importance of integrating technology as a tool to boost the economic, social and cultural development of a region.

The platform created brings together relevant tourist information, covering accommodation, gastronomy and handicrafts, as well as including an interactive map that facilitates the location of points of interest. This responds to the initial problem of the lack of a unified digital medium for promoting tourism in the area.

In terms of objectives, the project achieved all of those proposed. The analysis of the organisational context and the identification of the participants were fundamental to structuring the platform.

The design of profiles such as administrators, artisans, hosts, chefs and tourists allowed each user to have clear functions adapted to their needs. This order favoured the implementation of specific functionalities for each role during the construction of the application, optimising the user experience.

In terms of design, the creation of wireframes and visual prototypes with Balsamiq was decisive in aligning expectations between what was planned and the final result. The use of Bootstrap during implementation ensured a visually appealing, functional interface that could be adapted to different devices, which is essential to guarantee access for all types of users.

The construction and integration of the WebApp sections represented one of the project's greatest achievements. The gastronomic section allowed dishes to be documented with detailed information on their origin, ingredients, and location; the accommodation section provided complete and georeferenced data; and the artisan catalogue opened up a space for visibility for local products.

The connection between the frontend developed in React.js and the backend in Node.js with MongoDB was seamless, ensuring that data was handled efficiently.

Functional testing, carried out on different browsers and devices, was crucial to guarantee compatibility and the correct display of content. Adjustments to the interactive map for small screens were key to improving usability and providing a satisfactory experience for end users.

Finally, the delivery of the prototype allowed the local community to interact directly with the application, as the feedback received highlighted the usefulness of having a tool that concentrates all tourist information in one place. Similarly, users identified the platform's potential to expand the promotion of local businesses and facilitate the organisation of tourist activities. In conclusion, the project achieved its overall objective and laid the foundations for future improvements and expansions. This prototype is a first step towards the digital transformation of tourism in the Huasteca Hidalguense, promoting responsible, sustainable and inclusive tourism.

Its practical implementation can contribute significantly to strengthening the cultural identity of the region, attracting new visitors and, above all, boosting the local economy through the visibility and accessibility of its services and products.

Declarations

Conflict of interest

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

Contribution of the authors

Salazar-Casanova, Hermes contributed to the organisation and conduct of interviews with stakeholders, selection of the development methodology to be implemented, development of the prototype, research and compilation and organisation of project information, creation of the work plan and writing of this article.

Mendoza-San Juan, Luis Alberto contributed to the development of the prototype, drafting of the Software Requirements Specification (SRS), and selection of tools and technologies to be used for development.

Meneses-Flores, Arturo Élfego contributed to the development of the project, testing, presentation of the prototype to end users, and gathering feedback for the application of adjustments and adaptations.

González-González, Fabiola contributed to the organisation and conducting of interviews with stakeholders, the collection of information, suggestions and recommendations for defining the architectural and structural design of the prototype, as well as the definition of the colour palette to be used on the web portal.

Availability of data and materials

The information used in this article is available in the publications of the various authors mentioned in the references. The information included in the Software Requirements Specification (SRS) was provided by the stakeholders.

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Special recognition goes to the local tourism service providers (artisans, accommodation owners, family restaurants and tourist guides from the municipalities of the Huasteca Hidalguense region) who dedicated their time to participating in interviews and user tests, sharing their knowledge of the region's cultural, natural and gastronomic attractions, as well as their real needs for the promotion of their products and services.

Finally, we would like to extend our gratitude to the Technological University of the Huasteca Hidalguense (UTHH) and the Software Development and Management Engineering educational programme for the institutional and academic support that facilitated the development of this research, as well as to all our colleagues and teachers who, with their observations and suggestions, contributed to improving the final result of the prototype.

This work reflects the collective effort of those who believe in the tourism potential of the Huasteca Hidalguense and in technology as a tool for its sustainable and inclusive growth.

Abbreviations

ERS Software Requirements Specification

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Competitive strategies of micro-entrepreneurs in southern Tamaulipas after the Covid-19 pandemic

Estrategias competitivas de microempresarios del sur de Tamaulipas después de la pandemia por Covid-19

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Abstract

The largest and weakest sector of an economy is that of microenterprises, as they generally operate in isolation and lack the administrative training necessary to optimize business management, nor do they have the financial resources to systematize or invest in technology. This paper presents the exploration phase of a research project aimed at identifying the profile of micro-enterprise leaders in the urban area of southern Tamaulipas. A questionnaire was used, and a stratified convenience sample was selected. Findings reported here include the average age of these leaders belonging to the millennial generation, with an average level of education exceeding high school completion. However, technologies and marketing strategies are not widely adopted. 76% attribute their competitive strength to the knowledge and guarantees offered by their products, and 60% recognize that listening to their customers is paramount. 76% of businesses are family-owned.

Resumen

El sector más grande y débil de una economía es el de las microempresas, ya que generalmente operan de forma aislada y carecen de la capacitación administrativa necesaria para optimizar la gestión empresarial, ni de los recursos financieros para sistematizar o invertir en tecnología. Este trabajo presenta la fase de exploración de un proyecto de investigación destinado a identificar el perfil de los líderes de microempresas en la zona urbana del sur de Tamaulipas. Se utilizó un cuestionario y se seleccionó una muestra estratificada por conveniencia. Los hallazgos reportados incluyen la edad promedio de estos líderes de la generación millennial, con un nivel promedio de educación superior a la preparatoria. Sin embargo, la adopción de tecnologías y estrategias de marketing no es generalizada. El 76% atribuye su competitividad al conocimiento y las garantías que ofrecen sus productos, y el 60% reconoce que escuchar a sus clientes es primordial. El 76% de las empresas son familiares.

Competitive strategies of micro-entrepreneurs in southern Tamaulipas after the Covid-19 pandemic

Objetivos	Methodology	Key findings / Contribution
<ul style="list-style-type: none"> Characterize micro-entrepreneurs (n=25) Identify competitive strategies, use of technology and management Recognize strengths and areas for improvement Online, telephone and paper survey 	<ul style="list-style-type: none"> Cross-sectional, non-experimental, qualitative & interpretative Universe: 7,942 micro-businesses (Tampico, Cd. Madero, Altamira) Convenience stratified sample (90% confidence) Validation: 5 experts + pilot (n=5) Analysis: graphs in Excel + qualitative coding 	<ul style="list-style-type: none"> Millennials predominate; medium-to-high education level Family businesses; long working hours (12.2h) Customer needs guide strategies Reliable local suppliers Use of Internet, barcode, computer

Retail trade, urban economy, formal and informal employment

Estrategias competitivas de microempresarios del sur de Tamaulipas después de la pandemia por Covid-19

Objetivos	Metodología	Hallazgos clave / Contribución
<ul style="list-style-type: none"> Caracterizar a los microempresarios (n=25) Identificar estrategias competitivas, gestión y uso de tecnología Reconocer fortalezas y áreas de mejora Encuesta en línea, telefónica y en papel 	<ul style="list-style-type: none"> Estudio transversal, no experimental, cualitativo e interpretativo Universe: 7,942 micronegocios (Tampico, Cd. Madero, Altamira) Muestra estratificada por conveniencia (90% de confianza) Validación: 5 expertos + piloto (n=5) Análisis: gráficas en Excel + codificación cualitativa 	<ul style="list-style-type: none"> Predominan millennials; escolaridad media-alta Negocios familiares; jornadas largas (12.2 h) Las necesidades del cliente guían las estrategias Proveedores locales confiables Internet, código de barras, computadora

Comercio minorista, economía urbana, empleo formal e informal

Area: Dissemination of and universal access to science

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Introduction

The general population requires information to make the most appropriate decisions for their needs. Business owners or managers can perform better and make their work more efficient if they have the right tools to organize their activities. Strategic planning, which necessarily includes data and statistical recording and adequate logistics in business operations, always brings short- and long-term benefits, whether for a large company or a micro-enterprise.

Records of all types of businesses or economic units in Mexico are available online through the National Statistical Directory of Economic Units (DENUE) of the National Institute of Statistics and Geography (INEGI) (INEGI, 2021b). The Ministry of Economy categorizes companies according to their size, which includes the number of people employed and the amount of their annual sales, but also by their economic activity, associated with the 2013 North American Industrial Classification System (Dini & Stumpo, 2020). This stratification is used by INEGI in its instruments such as the National Survey on Productivity and Competitiveness of Micro, Small and Medium-sized Enterprises (INEGI, 2019) and economic censuses.

According to the aforementioned indicators, micro-enterprises have between 0 and 10 employees and an income of up to \$222,517.20 USD in annual sales (Dini & Stumpo, 2020; Ministry of Economy, 2009). The economic activity sectors stratified by INEGI (2016) are shown in Figure 1, where manufacturing industries accounted for 23.6% of the Gross Domestic Product -GDP- and the trade sector was the fastest growing in real terms at 4.4%.

The 2019 economic census in Mexico showed that Micro, Small and Medium-sized Enterprises -MSME- accounted for 93.6% of all economic units in the private and parastatal sectors and employed 43.3% of the workforce (INEGI, 2021a). Of this universe of MSMEs, 97.5% are micro-businesses, while small businesses represent only 2.4% of the total and medium-sized businesses 0.1%.

Considering the economic activity of MSMEs in 2019, as shown in Figure 1, 46.4% of the total corresponded to trade, 40.6% to non-financial private services, 12.4% to manufacturing, and 0.6% to other economic activities (INEGI, 2021a). Thus, commercial activity was predominant in micro-enterprises, mainly because it was an affordable economic alternative for almost any type of person.

Box

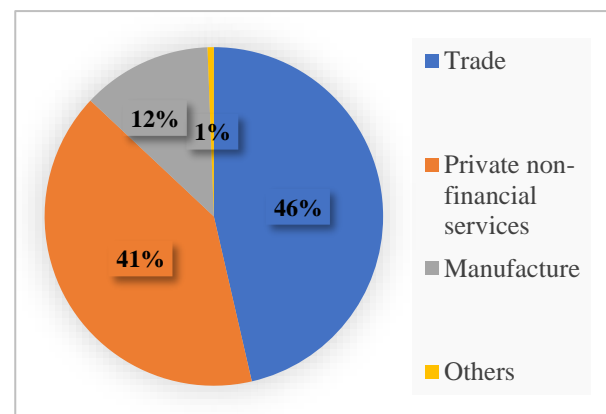


Figure 1

Economic activity of MSMEs in Mexico

Source: Owned based on (INEGI, 2021a)

1. Background

In Latin America, MSMEs are a fundamental component of business fabrics. However, their contribution to GDP is only 30%, which means that, due to their heterogeneous structure and low value-added products, there is a productivity gap (Stezano, 2020). These gaps include organizational and administrative capacities, technical and technological resources, management, and positioning on social media.

Productive development for the MSME sector in Latin America has been promoted through a strategy that includes: 1) defining its importance based on heterogeneous characteristics, potential for each subgroup, and scope of the project; 2) clarity of economic and competitiveness objectives, in addition to social objectives; 3) the location of these objectives within national economic policy; and 4) the sustainability of the project through its continuity, evaluation, feedback, and strengthening towards the institutional maturation of the instruments (Stezano, 2020).

In Mexico, the importance of MSMEs was significant in 2013 due to: productivity in the manufacturing sector, 48% of the total; the number of companies in the trade sector, 48.3% of establishments; and a certain predominance of the service sector as an employer, 38% of total employed personnel, while for the trade sector it is 29.6% (Stezano, 2020).

Micro-enterprises contributed 7.08% to GDP, while medium-sized enterprises contributed 7.47% and small enterprises 13.15%. Although the share of census value added to production was much higher in the commerce sector for micro-enterprises (67%) compared to other sectors or company sizes, this sector experienced difficulties in productivity and profitability, with indicators of decline of -4.6% and -10.2%, respectively, during the period 2008-2011 (Stezano, 2020).

1.1 MSMEs in Tamaulipas

In 2018, the state of Tamaulipas, in northeastern Mexico, was home to 2.27% of Mexico's MSME establishments, with 2.34% of the employed workforce (INEGI, 2021a). Tamaulipas ranked 10th out of 32 states in terms of GDP per capita, with \$10,623.94 USD and in terms of GDP growth (-0.2%). Tamaulipas ranked 14th in average income for full-time workers with \$437.15 USD and 13th in terms of people with incomes below the welfare line (0.99% of the employed population).

However, it ranked 8th in terms of people with incomes above the state average in relation to the employed population (28%). In terms of the economically active population receiving job training (2%), it ranks 25th in the country (IMCO, 2021a).

In particular, the southern metropolitan area of Tamaulipas, comprising Tampico, Ciudad Madero and Altamira, Tamaulipas, together with the Veracruz municipalities of Panuco and Pueblo Viejo, had a population ranging from 500,000 to one million inhabitants, and ranked 14th out of 25 in the 2021 Urban Competitiveness Index of the Mexican Institute for Competitiveness, a non-governmental organization. This area ranked 19th out of the 69 analyzed in terms of people below the welfare line of the economically active population, with 13.5%. The monthly salary for full-time workers was \$441.82 USD, above the average for Tamaulipas (IMCO, 2021b).

Thus, southern Tamaulipas had 47.5% of the employed population in informal employment, ranking 42nd out of the 69 analyzed, while 22.5% of the employed population had no income, placing the area 27th out of 69. In terms of technological access, 93.3% of households have mobile phone lines, but only 36.3% of households have a computer and internet access (IMCO, 2021b).

During 2019, the economic census in Tamaulipas showed that 45.6% of male owners and 50.6% of female owners of MSMEs were aged 41 or older. Meanwhile, the educational level of the staff of these establishments was basic education in 46.3% of cases for female owners and 42.8% for male owners, both below the national average. In terms of staff training, the census also showed that only 0.9% of female owners did so at a higher rate than the national average, while 1.5% of male owners did so at a lower rate than the national average. In terms of staff turnover, in both cases of female and male owners, the averages are higher, 14.6% and 14.2%, respectively, than at the national level (INEGI, 2021a).

Regarding the technological resources used by MSMEs, only 10.3% of female owners and 20.3% of male owners had computer equipment, while 8.7% of female owners and 17.5% of male owners used the internet in their establishments. Based on the above, it is understood that only 2% of MSMEs made sales over the internet; while 91.2% of female owners and 82.1% of male owners used cash as a means of payment for their purchases, and 92.9% of female owners and 83.9% of male owners did the same for their sales (INEGI, 2021a).

The proportion of informal MSMEs was 78.4% for female owners and 64.2% for male owners. This means that they do not pay employer contributions or social benefits to their staff, nor do they have accounting, legal or administrative services, nor do they spend on marketing or business advice. Of all the staff employed by female owners, 65.2% are in informal MSMEs, compared to 45.5% of staff employed by male owners (INEGI, 2021a). In other words, women tend to be more informal than men in MSMEs.

These differences between male and female micro-business owners in Mexico have been studied and mainly affect business continuity, based on their level of education. However, if the business was started with the aim of practicing their profession, then women are more stable (Ortiz Rodríguez, Picazzo Palencia, & Alvarado Lagunas, 2020).

This allows us to visualize a dynamic, heterogeneous, but competitive area, since in some areas it is in a medium-high position and very few elements are in a low position, such as the gender gap in the workforce and wage inequality in the same sense - for which it ranks 60th and 64th, respectively, out of 69 (IMCO, 2021b). Of no less importance during 2022 was the impact of human migration flows, generally from Central America.

In this context, retail trade is one of the most common activities in this geographical area of southern Tamaulipas, and retail stores are a business model where senior citizens seem to be the usual owners, as well as the next generations of their families. Women also play a very important role, often without receiving a salary, and empiricism predominates, as training or administrative education, for example, is not common (Varela Villegas, 2008).

1.2 Other studies on MSMEs

In various studies that have been carried out on the characteristics of leadership in MSMEs, the heterogeneity of this productive sector itself and in the different regions of Mexico can be noted because some choose to let their employees make certain decisions without supervision, which Rojero-Jiménez, Gómez-Romero and Quintero-Robles (2019) call *laissez-faire*.

Although its scope is ambiguous, the authors point out that it is the 'result of the activities achieved by subordinates, due to an almost indecipherable mixture of trust in their leader, whom they want to imitate and who knew how to sell them a shared vision that, without being permanently close to them, taught them what to do and how to do it' (p. 185).

In addition to the above characteristics, Rojero-Jiménez and his colleagues in the state of Durango found that the leader's concern for improving the living conditions of their employees is a statistically significant factor with the type of employees they have.

This is related to: learning and acceptance of change, effective communication, contribution to the group, emotional intelligence and ease in supporting others, and flexibility (2019).

Márquez Gómez, Bobadilla Beltrán, and Carreño Saucedo (2020) found in the state of Mexico that the level of leadership of MSME entrepreneurs is low for 38.9% of the sample, which implies the need for training in motivation, teamwork, innovation, and risk-taking. However, the percentages are higher for attitudes such as challenging processes with 42.5%, encouraging others, 43.7%, enabling others to act with 45.8%, modelling the way, 46.7%, and inspiring a shared vision with 49.7%. This involves knowledge, skills, and attitudes when designing training for microentrepreneurs.

A study in the state of Aguascalientes on business philosophy in MSMEs links leadership characteristics with total quality management models in organizations. Loza-Covarrubias and Hernández-Castorena (2021) studied leadership associated with the European Model of Business Excellence, concluding that it is partially established that senior management leaders—owners, managers, directors—are the ones who establish the mission, vision, values, and ethical principles, so that they can be the reference model for their employees. These results barely exceed half of the required score in companies of all three sizes—micro, small, and medium—but it is noteworthy that they are not far off, ranging from 55% to 63%.

According to the results of this research, MSMEs have weaknesses in terms of leadership, including: a) having a clear vision for the future and a well-established mission, b) having a leader who acts as an example to employees in terms of organizational values, c) having clear objectives in organizational management so that the leader can establish an effective strategic route, d) evaluating the performance of leaders in the organization to bring about continuous improvement. The leaders of micro-enterprises have an entrepreneurial profile, so the improvement of their skills must be based on their areas of opportunity and the context in which they operate. Leadership in the organization is the ability to achieve sustainable results over time, which requires defining a strategic direction that allows it to develop competitive advantages (Gutiérrez Pulido, 2020).

Formal programs have been proposed for the development and professionalization of leaders of small and medium-sized enterprises (IMCO, 2021c) with the primary objective of integrating them into production chains. Something similar could be proposed for micro-enterprises in their context.

On the other hand, the social responsibility of MSMEs is a characteristic that leaders must bear in mind in order to maintain a relationship with the environment that allows for sustainable development, which enhances both their financial and social development (Cañizares Arévalo, 2020). This aspect is very important because micro-entrepreneurs generally focus on economic factors and customer satisfaction, which are linked, followed by employees, and almost never on the environment.

The results of this study by Cañizares Arévalo show the need to sensitize and raise awareness among business units to 'create a culture of environmental and social responsibility, where real commitments are made to the rational use of natural resources geared towards sustainable development' (2020, p. 114). This study also found that micro-enterprises do not apply good governance practices – ethical behavior 23%, transparency 19%, respect for human rights 13% – nor do they have a culture of solid waste separation. However, micro-entrepreneurs expressed their willingness to move towards corporate social responsibility.

Considering that the scarce resources of households become the main asset for obtaining survival income without visualizing their development, at least in a formal micro-business (Ramírez López, 2019), these initiatives remain between economic, fiscal and labor formality and informality.

During 2023, female workers predominated in microeconomic units with 50.5%, compared to 49.5% of men (INEGI, 2025). The characteristics outlined above are particularly noticeable in marginalized or rural areas (Alonso Olivares, 2020). This leads to the identification of the need for micro-enterprise owners or leaders to have the skills to improve the performance and productivity of their businesses.

One of the basic elements is the recognition of the need for ongoing training to exchange knowledge and increase the competitiveness of the business (Alcívar Mero, Alarcón Chávez, & Ferrin Schettini, 2020).

One of the aspects that evolved exponentially in micro-businesses survived and improved during the pandemic, and those that were created because of it, is technology and marketing methods, including social media, for example. The digital transformation of microbusiness processes has involved requirements for computer equipment or mobile devices, but also various types of applications, innovative services such as payments and bank transfers, the use of barcodes or QR codes, and many others that have also triggered the need to anticipate very sensitive issues such as information security or cybersecurity (Garduño Guevara, 2025). This is no small task, and owners must be trained to do it.

The challenge or utopia will be to use all resources effectively and consistently, to develop the organization's capabilities, so that knowledge management – embodied in manuals and procedures, for example – advances to give rise to a learning organization (Adams & Schmelkes, 2008).

1.3 Context of the study

The objective of the present study was to identify the characteristics of microentrepreneurs located in the southern urban area of the state of Tamaulipas, which includes the municipalities of Ciudad Madero, Tampico, and Altamira, by applying a questionnaire and a semi-structured interview to a sample of those registered by INEGI. This proposal made it possible to qualify the environment of the most vulnerable business sector in the southern part of Tamaulipas, which led to the design of a relevant training proposal for this sector of microentrepreneurs as an alternative for development.

In addition, the study was conducted after the long period of lockdown due to the Covid-19 pandemic, in the summer of 2022. During this process, people changed their habits in every way, including those related to the purchase of goods, which triggered new business models with online shopping, but also closed commercial options that did not adapt to the new circumstances.

In accordance with the federal policy to promote MSMEs (Ministry of Economy, 2024), this project was proposed as a social benefit for micro-entrepreneurs located in the urban area of southern Tamaulipas.

2. Methodology

This work is a cross-sectional study, as the information was collected in a short period of time. It is non-experimental, qualitative, and interpretive (Hernández Sampieri, Fernández Collado, & Baptista Lucio, 2014), and aims to identify the characteristics of microentrepreneurs engaged in retail trade through shops in the urban area of southern Tamaulipas.

The universe to be studied includes 7,942 retail establishments with 0 to 5 employees, registered with DENUÉ (INEGI, 2021b) for the area under analysis, distributed as follows: 4,611 in Tampico, 2,054 in Ciudad Madero, and 1,277 in Altamira. A convenience sample was chosen for reasons for personal safety of the researchers.

The Survey on Competitiveness Strategies for Microbusinesses by Meléndez and Sotalero (cited by Alonso Olivares, 2020) was used as the base instrument, which was properly validated for application in the context under investigation. The semantics and scope of the instrument were reviewed by a panel of five experts. The recommended modifications were made and captured in the Google Forms application. It was applied to five microentrepreneurs who did not belong to the selected sample to validate the interpretation and receive feedback.

This instrument included indicators to recognize the competitive and differentiating strategy used by microentrepreneurs - identification of their customers' requirements, their sphere of influence, benchmarking and their strengths vis-à-vis the competition, as well as their marketing strategies and the technological resources they use—how they manage their businesses—planning their activities, personnel management, leadership and decision-making—and what their strengths are vis-à-vis the competition—supplier network and its effectiveness, as well as areas for improvement.

The final instrument was initially sent as an online electronic questionnaire to each of the microentrepreneurs in the sample, either by email or via a mobile social network, according to publicly available information. In cases where these communication channels did not work, telephone contact was established, and in several cases the questionnaire was administered in person in a semi-structured interview format. The responses to the questionnaire were then recorded.

The collection of information was a challenge, given the doubts and fears of microbusiness managers and owners. The process was slow and fraught with difficulties beyond the scope of this study. Some of these difficulties may be associated with the irregular fiscal situation in which they find themselves, as they are associated with family work, as identified by Ramírez López (2019).

This document presents an exploratory and cross-sectional approach carried out in the summer of 2022. The findings were organized using Excel and analyzed. A basic analysis of the open-ended responses was also carried out to qualitatively interpret the characteristics of micro-entrepreneurs.

3. Results

This section presents and analyses the results of each of the aspects considered in the questionnaire applied during the research and finally provides a general profile.

3.1 Demographics of microentrepreneurs

In this study, 25 responses were collected and captured for exploratory analysis. 11 responses were from men and 14 from women. 8 of them live in Tampico and 17 in Ciudad Madero. 15 of the 25 respondents were born in southern Tamaulipas. 3 of the people who answered did not indicate their place of birth.

The average age of the owners is 40.84 years with a standard deviation of 11.36, with a minimum of 21 years and a maximum of 77 years. In this case, it can be observed that the millennial or 'Y' generation (Iberdrola, 2017) is the predominant one. This situation had not been established as a hypothesis at the start of the research.

Half of the people (13/25) are single, 9 declared themselves married, and only 3 divorced or separated.

The educational level of the people was measured using a Likert scale, where 1 is primary school completed, 2 is secondary school, 3 is high school, 4 is an incomplete bachelor's degree, and 5 is a completed bachelor's degree. The average educational level of the sample is 3.52, which implies that the level of schooling is higher than high school, with a standard deviation of 1.26.

Something that caught our attention was the responses about speaking another language. This question was included with the expectation of finding someone of Indigenous origin who spoke the language of their parents, for example. The result was nil in that regard, but four people were found who speak English and two of them speak another language like French or Portuguese. Above all, the case of Portuguese is unexpected, unless there are immigrants among the surveyed population.

3.2 Micro-enterprises

The line of business of the surveyed businesses, as shown in Figure 2, is retail grocery stores, such as convenience stores or mini-supermarkets (10), stationery shops (4), bakeries or tortilla shops (3), computer and printing services (3), laundries or dry cleaners (2), flower shops (2) and a café. All have a maximum of five employees (1), although most (10) have only one employee, and six have none, because they are the ones who directly run the microbusiness.

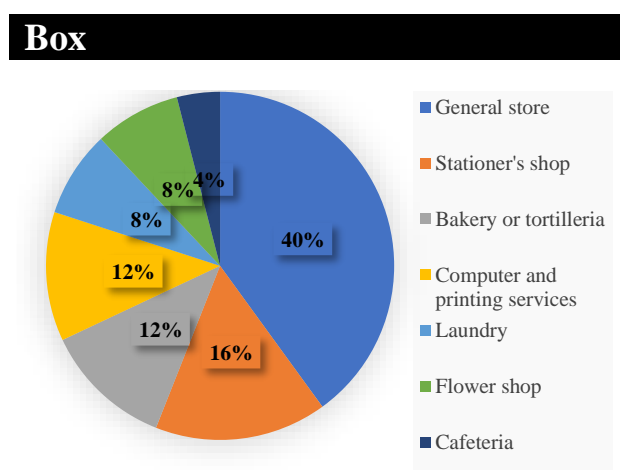


Figure 2

Business focus of micro-enterprises

Source: Owned

In relation to the demographics of the micro-enterprises surveyed: 19 out of 25 are family-owned micro-enterprises, 3 are non-family-owned, and 3 preferred not to answer.

The average age of the business is 10.26 years, with a minimum of six months and a maximum of 30 years. However, one-fifth of the total has been in existence for six months and four have been in operation for 20 years. Therefore, the standard deviation is 9.94 years.

Family members work in micro-enterprises with the following frequency: 11/19 have one family member, mainly a spouse or child; 5/19 have two family members, and 1/19 have three family members. This implies that most employees (89.5%) are family members.

The number of hours per day spent working in the micro-enterprise averages 12.24 hours, with a standard deviation of 2.93. The most common are 12 hours (4), 14 hours (4) and 16 hours (4), which is the maximum value. Meanwhile, 18 of the 25 micro-businesses surveyed operate every day of the week, and 7 of 25 operate only six days a week.

3.3 Competitive strategies for micro-businesses

Almost half of micro-entrepreneurs (11/25) say that their main strategy for increasing sales is to listen to their customers' suggestions, 7/25 compare themselves with the competition, and others ask their customers directly (4/25) or analyze the characteristics of the best-selling products (3). Customer needs are the basis for improving sales.

Thus, when asked about the characteristics that set them apart from their competitors, 10/25 mentioned knowledge of the qualities of their products as a priority, 9/25 said a good relationship with the supplier or the guarantee of their products, 7/25 said a good relationship with the customer, 6/25 said their prices are low, 5/25 said they have experience in the field, and also those who have customized products. It is therefore possible to identify that their main differentiating factor is based on the qualities of the products they offer and their guarantee.

Respondents were then asked about customer loyalty, and 22/25 said that customers always or almost always return to their business. However, as shown in Figure 3, only 17/25 carry out some marketing activities such as: internet and/or social media posts (7/25), posting advertisements on cardboard signs or blackboards outside their business (4/25), posting advertisements on banners (2/25) and some with cards or flyers that they distribute or through a commission to people to bring in customers.

Box

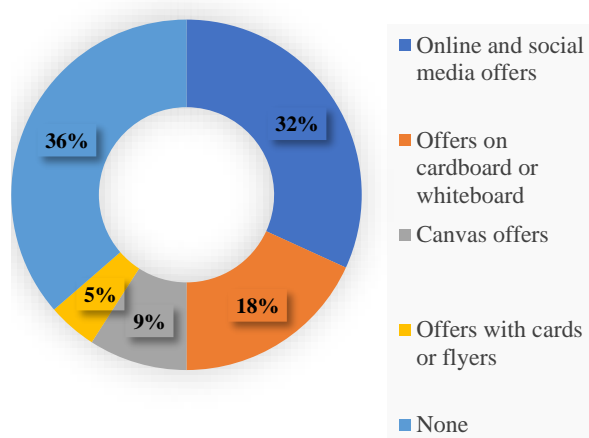


Figure 3

Marketing actions of micro-enterprises

Source: Owned

However, when respondents were asked about the reasons why they do not carry out certain marketing activities, most did not answer, and only two people commented that it was due to cost issues. When asked in more detail about the effectiveness of their marketing mechanisms, 12/25 stated that the activities and means they use for this purpose always or almost always work.

Microentrepreneurs were also asked about the technological resources they used for their businesses. As shown in Figure 4, half of them use the internet, but 44% do not use any technological resources. However, those respondents who stated that they did not use technology said that they did not have the means (3/25) and that they were not interested or did not need it (3/25). Perhaps, they also lack the training to do so.

These last three elements show how some microentrepreneurs are using certain technologies that benefit the visibility and management of their businesses. For many others, there is room for improvement in the use of information technologies, because it is very likely that all microentrepreneurs have a smart mobile device.

Box

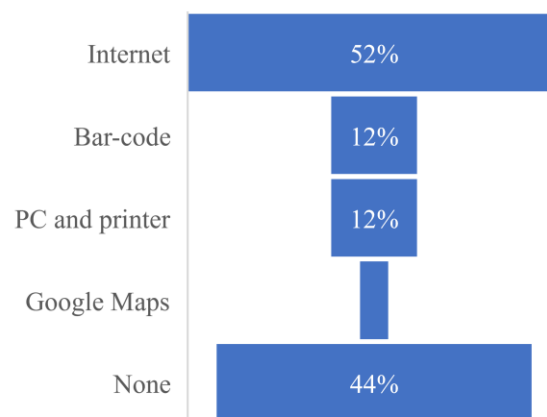


Figure 4

Technological resources used by micro-enterprises

Source: Owned

3.4 Microenterprise management

Regarding planning business activities, 17 out of 25 microentrepreneurs said they always or almost always do so, while only one said they never do. About staff turnover, 20 out of 25 respondents confirmed that there had been no changes during the last year. This could also be explained by the fact that most of these are family businesses.

Associated with the above, when microentrepreneurs were asked about how they motivate their employees, the responses were, in order of priority: 7/25 with good salaries, 7/25 with flexible hours, and 6/25 with commissions. 9/25 of them did not answer, even though they were given options to choose from in a menu. Perhaps the fact that the vast majority are family businesses is associated with a lack of specific attention to staff working conditions.

3.5 Competitive strengths of micro-enterprises

For 20/25 of micro-entrepreneurs, their suppliers are local and always or almost always deliver on time and in accordance with the contract, which means they can guarantee the expected service.

At the same time, they fulfil their commitments to their customers in the same way. This is one of the strengths of their businesses. Another one is that, in 18/25 cases, the micro-entrepreneur personally manages their business, while in another 6/25 cases it is managed by their partner or a family member, which means they have continuous monitoring of the processes related to its operation. Decisions are made in the same way.

Finally, when it comes to visualizing improvements to their business, microentrepreneurs assert that the priority is: a change in appearance and/or furniture and equipment (8/25), training and performance of their employees (7/25), and attention to products (3/25). One person stated that they needed a loan to improve. It is noteworthy that 7 of the 25 microentrepreneurs did not propose anything or said that they would do something else but did not specify what. Here again, the respondents had a menu of options to choose from and an open opportunity to express themselves, but they did not complete it.

4. Conclusions

As these are the results of an exploratory exercise, carried out during a unique period due to the Covid-19 pandemic, some of the findings have been unexpected. However, they have not been far removed from those found in the report for Latin America (Stezano, 2020).

Indications have emerged regarding the necessary attention, especially associated with the use of technologies and marketing strategies. For example, by identifying in this exercise that the average age of microentrepreneurs is in the so-called millennial generation, one would expect a wider use of these resources.

Above all, because the level of education is not low either, as the average is above high school graduation. Therefore, these indicators will need to be analyzed.

Another specific area of research is family micro-enterprises, with their very specific characteristics and problems, to interpret many of the responses and address this area in a focused manner.

Likewise, the complete characterization of the profile of these micro-entrepreneurs in the area has made it possible to design a training and refresher program for them and the people they designate, as a strategy to enhance their strengths, but also as an opportunity to overcome their weaknesses.

The areas of opportunity for training these micro-entrepreneurs are strategic business planning, the use of technology and social media for commercial and promotional purposes. Today, it is even easier to design and implement a micro-enterprise development program using Artificial Intelligence resources, for example.

Declarations

Conflict of interest

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

Contribution of the authors

Soto-Hernández, Ana María: Contributed to the project idea, research method, writing and editing.

Alonso-Olivares, Saúl Emmanuel: Contributed to the research technique, and data analysis.

De la Garza- Saldívar, Sandra: Contributed to the research on context analysis.

Availability of data and materials

The data obtained are not available.

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Article

Abbreviations

DENUE	National Statistical Directory of Economic Units
GDP	Gross Domestic Product
INEGI	National Institute of Statistics and Geography
MSME	Micro, Small and Medium-sized Enterprises

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Basics




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Implementation of a digital intermediation model as a competitive advantage of a personalized service in a hostess travel agency

Implementación de un modelo de intermediación digital como ventaja competitiva de un servicio personalizado en una agencia de viajes hostess

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




Abstract










This article analyzes digital intermediation in online travel agencies as a key strategy for brand strengthening and customer loyalty in the tourism sector. The objective is to identify the factors that influence the acceptance and effectiveness of digital intermediation models, highlighting their strategic relevance for the competitiveness and sustainability of tourism organizations in the context of digital transformation. The methodology adopted follows a mixed-methods approach, with a predominance of quantitative analysis, based on the application of structured surveys to users with experience or interest in contracting tourism services online, as well as descriptive analysis of the collected data. Additionally, a qualitative analysis of digital interaction and users' perceptions regarding personalized attention and support throughout the purchasing process was incorporated. The results show that the combination of personalized service, multichannel communication, strategic use of social media, and content marketing strengthens user experience and trust in online travel agencies. However, barriers related to perceived risk and the lack of process standardization were identified, particularly in micro and small agencies, although these limitations can be mitigated through digital support strategies and direct communication. The main contribution of this study lies in providing an empirical reference for the design of user-centered digital intermediation models, supporting managerial decision-making and the development of digital marketing strategies in the tourism sector.

Resumen

Este artículo analiza la intermediación digital en las agencias de viajes en línea como una estrategia clave para el fortalecimiento de la marca y la fidelización de los clientes en el sector turístico. El objetivo es identificar los factores que influyen en la aceptación y la eficacia de los modelos de intermediación digital, destacando su relevancia estratégica para la competitividad y la sostenibilidad de las organizaciones turísticas en el contexto de la transformación digital. La metodología adoptada sigue un enfoque de métodos mixtos, con predominio del análisis cuantitativo, basado en la aplicación de encuestas estructuradas a usuarios con experiencia o interés en contratar servicios turísticos en línea, así como en el análisis descriptivo de los datos recopilados. Además, se incorporó un análisis cualitativo de la interacción digital y las percepciones de los usuarios con respecto a la atención personalizada y el apoyo a lo largo del proceso de compra. Los resultados muestran que la combinación de un servicio personalizado, la comunicación multicanal, el uso estratégico de las redes sociales y el marketing de contenidos refuerza la experiencia del usuario y la confianza en las agencias de viajes online. Sin embargo, se identificaron barreras relacionadas con la percepción del riesgo y la falta de estandarización de los procesos, especialmente en las microempresas y las pequeñas agencias, aunque estas limitaciones pueden mitigarse mediante estrategias de apoyo digital y comunicación directa. La principal contribución de este estudio radica en proporcionar una referencia empírica para el diseño de modelos de intermediación digital centrados en el usuario, lo que respalda la toma de decisiones gerenciales y el desarrollo de estrategias de marketing digital en el sector turístico.

Implementation of a Digital Intermediation Model as a Competitive Advantage for Personalized Service in a Hostess Travel Agency		
Goals	Methodology	Contributions
 <p>Analyze the factors influencing the effectiveness of digital intermediation in online travel agencies.</p>	 <p>Applied research with a mixed-methods approach, with a predominance of quantitative analysis.</p>	 <p>Identification of personalized service, multichannel strategies, and digital marketing as core elements of effective digital intermediation.</p>
 <p>Identify successful digital practices that strengthen user experience, trust, and customer loyalty.</p>	 <p>Application of structured surveys to 110 users with experience or interest in online tourism services.</p>	 <p>Evidence that human support within digital environments increases trust and purchase intention.</p>
 <p>Propose an analytical reference framework to support strategic decision-making in digital tourism intermediation models policies in this sector of the industry.</p>	 <p>Descriptive analysis of variables related to personalized service, multichannel communication, social media use, and customer satisfaction.</p>	 <p>Proposal of a practical framework to enhance customer loyalty and competitiveness in online travel agencies.</p>

Digital intermediation; online travel agencies; digital marketing.

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Intermediación digital; agencias de viajes online; marketing digital

Area: Development of strategic leading-edge technologies and open innovation for social transformation

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Introduction

Digital intermediation of tourism services has become one of the most significant challenges for the competitiveness, sustainability, and differentiation of travel agencies in the context of digital transformation. This challenge has gained particular relevance due to changes in consumer habits, the expansion of e-commerce, and the growing preference of users for digital channels in the planning and booking of tourism experiences. In this scenario, the transition from traditional face-to-face service processes to online models entails risks associated with the loss of consumer trust, service standardization, experience quality, and customer loyalty.

Despite the economic importance of the tourism sector in Mexico and the sustained growth of e-commerce, the adoption of structured digital intermediation models remains uneven, particularly among micro and small travel agencies. Although the use of digital platforms and social media has become widespread, many organizations lack formal strategies to integrate personalized service, multichannel approaches, and digital marketing as articulated elements of their business model. Several authors point out that the lack of systematization in digital processes limits value creation and the consolidation of competitive advantages in highly dynamic environments (Ricart, 2009).

Recent studies have shown that the digitalization of services, when accompanied by strategic customer experience management, contributes to improving purchase intention, trust, and loyalty toward tourism brands. In particular, service personalization and the strategic use of digital channels positively influence perceived value and decision-making in the online booking of tourism services, especially among young and digitally active consumers (Bricio Samaniego et al., 2018). In this context, the present study aims to analyze current digital intermediation practices in online travel agencies, with the objective of identifying the factors that influence model acceptance, user experience, and customer loyalty. Using an applied and descriptive approach, quantitative and qualitative data obtained from users with experience or interest in contracting digital tourism services are examined, making it possible to identify behavioral patterns, barriers, and strategic opportunities.

The added value of this research is based on four lines of analysis:

- Digital intermediation models and personalized service in online travel agencies.
- Strategic use of digital platforms and social media as communication and sales channels.
- Multichannel approaches and continuous support as differentiating elements of the customer experience.
- Satisfaction, trust, and loyalty indicators associated with digital intermediation.

Each of these dimensions is analyzed based on empirical evidence and recent academic literature, generating a relevant contribution for researchers, digital tourism professionals, and decision-makers interested in strengthening the competitiveness of the tourism sector in the digital economy.

2. Theoretical framework: Conceptual foundations for digital intermediation and marketing in online travel agencies

The present theoretical framework supports the analysis of digital intermediation and digital marketing applied to online travel agencies through a critical review of concepts, models, and theoretical contributions related to tourism, electronic business models, service intermediation, and digital consumer behavior. It also integrates contemporary approaches to content marketing and customer loyalty in digital environments, with the aim of understanding how service personalization and multichannel strategies influence value creation and competitive advantage. This conceptual foundation supports the design of the proposed model and contextualizes the research findings within the current dynamics of the tourism sector and the digital transformation of services.

2.1 Tourism and Its Economic Relevance in the Digital Environment

Tourism is a social, cultural, and economic phenomenon that involves the movement of people outside their usual environment for personal, professional, or business purposes for a period of less than one year (World Tourism Organization) [OMT], 2008).

This sector represents a strategic source of income for national and local economies, as tourism expenditure includes the acquisition of goods and services before and during travel, generating a significant economic spillover.

In the Mexican context, tourism is positioned as one of the sectors with the greatest growth potential, acting as a catalyst for regional development and job creation. This dynamism has driven the transformation of traditional tourism intermediation models, encouraging the adoption of digital schemes that expand service reach and enhance the user experience. Travel agencies play a key role in this ecosystem by providing information, guidance, and integrated access to tourism products, concentrating the management of multiple services within a single point of contact. The evolution of the sector requires these organizations to incorporate digital tools that respond to the new demands of consumers.

2.2 Traditional Travel Agencies and Their Role as Intermediaries

A travel agency is defined as a professional entity dedicated to the organization and commercialization of package tours, either through its own packages or those developed by wholesale travel agencies (Guerra, C. 2009). These agencies are primarily classified as wholesalers and retailers, with the latter acting as intermediaries between the end customer and tourism service providers.

Three essential functions of travel agencies are identified: customer guidance, intermediation in reservation management, and the creation of integrated tourism products. In Mexico, the General Tourism Law recognizes travel agencies as tourism service providers, regardless of whether they operate in a physical or virtual modality. However, traditional travel agencies are characterized by having a physical location and face-to-face interaction with customers, which may limit their geographic reach and their capacity to adapt to the rapid changes of the digital environment.

2.3 Online Travel Agencies (OTAs) and the Transformation of the Service Model

Online travel agencies, known as OTAs (Online Travel Agencies), perform the same functions as traditional agencies but operate exclusively through digital platforms.

This model eliminates the need for physical infrastructure and enables services to be offered in a continuous, flexible, and global manner.

The growth of OTAs intensified after the COVID-19 pandemic due to changes in consumer behavior and increased trust in digital transactions. Among the factors explaining their rapid expansion are ease of access to detailed information, real-time price comparison, and reduced operating costs.

Nevertheless, this model also faces challenges related to risk perception, user trust, and the absence of personalized support, which creates opportunities for hybrid digital intermediation models with an emphasis on human-centered service.

2.4 Electronic Business Models and Digital Commerce

The business model defines the way an organization creates, delivers, and captures value by integrating strategic and operational decisions (Ricart, 2009). With the incorporation of Information and Communication Technologies (ICT), the concept of the electronic business model, or e-business, emerges, focusing on operations and transactions carried out in digital environments.

Electronic business models are classified according to the type of relationship between the actors involved, highlighting schemes such as Business to Customer (B2C), Business to Business (B2B), and Customer to Customer (C2C) (Brzozowska & Bubel, 2015). In the tourism sector, the B2C model is predominant, as it facilitates a direct relationship between agencies and the end consumer, supported by digital marketing strategies, search engine positioning, and electronic payment platforms.

These models allow companies to expand their market reach, reduce costs, and offer personalized experiences—key elements for competitiveness in highly dynamic digital environments.

2.5 Digital Intermediation Model in Tourism Services

The digital intermediation model is based on the efficient connection between supply and demand through technological platforms, where the agency acts as a facilitator of the purchasing process and customer support (Bellón, 2024). This approach makes it possible to generate added value through service personalization, multichannel strategies, and user experience management.

Unlike mass booking portals, personalized digital intermediation prioritizes the building of trust-based relationships, continuous follow-up, and direct interaction through channels such as social media and instant messaging applications. According to Garrido (2023), this type of model strengthens customer loyalty and improves the perception of security in online transactions.

2.6 Content Marketing and Digital Consumer Behavior

Digital marketing has evolved from an approach focused solely on advertising to one centered on creating value-driven experiences for users (Bricio Samaniego et al., 2018). Content marketing has positioned itself as a key strategy for attracting, informing, and retaining customers through relevant, visual, and emotionally meaningful information.

Various studies indicate that high-quality content—particularly in visual and narrative formats—increases engagement and strengthens the brand–customer relationship (Toledo, 2022). Likewise, the strategic use of social media makes it possible to humanize the brand and generate digital communities based on trust and bidirectional interaction (Guerra, 2009).

Digital consumer behavior is characterized by a strong preference for immediacy, personalization, and direct communication. In Mexico, platforms such as Facebook, Instagram, and WhatsApp concentrate a large share of interaction between companies and consumers, consolidating their role as strategic channels for tourism marketing management (Briceño, 2023).

3. Methodology

The research was conducted using a mixed-methods approach of an applied and descriptive nature, aimed at analyzing a digital intermediation model as a strategy for strengthening brand positioning and customer loyalty in an online travel agency. The mixed-methods approach enabled the integration of quantitative and qualitative data, facilitating a more comprehensive understanding of the phenomenon under study and enhancing the validity of the findings (Hernández-Sampieri, Fernández-Collado & Baptista, 2014).

From a quantitative perspective, 110 structured surveys were administered to users with experience or interest in contracting digital tourism services, with the aim of identifying consumption habits, communication channel preferences, levels of trust, and factors influencing purchase decisions.

The data were analyzed using descriptive statistics, an appropriate technique for exploratory and descriptive studies in social and organizational contexts.

Complementarily, the qualitative approach was supported by the analysis of digital interactions and user-generated content on social media, as well as by the interpretation of perceptions associated with personalized support and user experience. This type of analysis is particularly relevant for understanding intangible dimensions such as trust, closeness, and loyalty in digital environments. The study population consisted of users who use or consider using online travel agencies. Sample selection was based on accessibility and voluntary participation criteria, using digital media for instrument administration. The questionnaires were specifically designed for this study and administered through electronic platforms, which made it possible to optimize the data collection process and ensure data consistency.

Finally, the integration of quantitative and qualitative findings supported the design of strategic recommendations aimed at implementing a digital intermediation model focused on service personalization, multichannel strategies, and strengthening the agency–customer relationship, contributing to the analysis of digital marketing in the tourism sector.

4. Results

This section presents the findings derived from the analysis of quantitative and qualitative data obtained through the application of digital instruments to users with experience or interest in contracting online tourism services. The results make it possible to identify consumer behavior patterns, perceptions of digital intermediation, and key factors associated with trust, service personalization, and the strategic use of digital marketing in travel agencies.

These findings directly address the research objectives, particularly the understanding of how digital intermediation and multichannel strategies influence purchase intention, user experience, and customer loyalty within the tourism sector.

4.1 Profile of the Digital Tourism Consumer

The analysis of the respondents' sociodemographic profile shows a clear concentration of users in the 20 to 30 age range (Figure 1), followed by the 31 to 40 age group. This result confirms that young adults constitute the segment with the greatest affinity for digital tourism services, characterized by a high level of familiarity with the use of technological platforms and social media.

Box 1

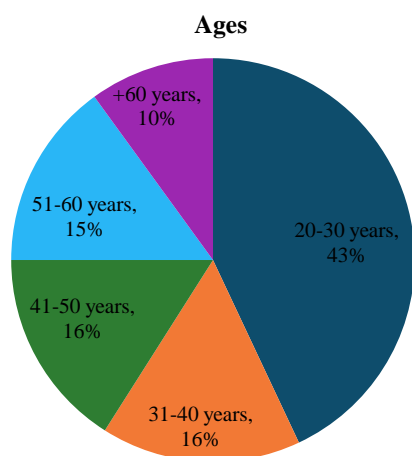


Figure 1

Age of the respondents

Source: Own Elaboration (2025)

Regarding travel habits, the results indicate that a significant proportion of participants take at least one trip per year (Figure 2), with leisure tourism being the main reason for travel (Figure 3).

Box 2

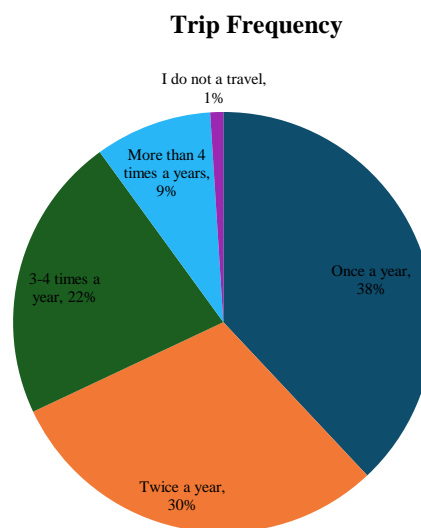


Figure 2

Travel frequency per year

Source: Own Elaboration (2025).

Box 3

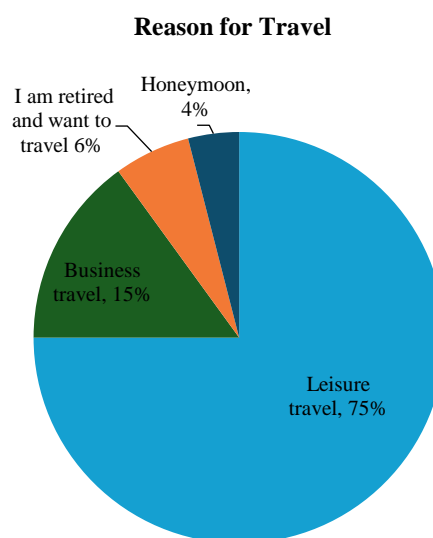
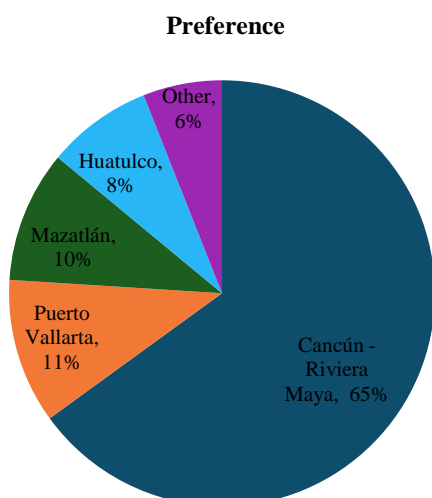


Figure 3

Purpose of travel

Source: Own Elaboration (2025)

Likewise, a predominant preference for beach destinations within the national territory is observed (Figure 4), which indicates a demand concentrated on accessible and recurring tourism experiences that are well suited to being addressed through personalized travel packages.

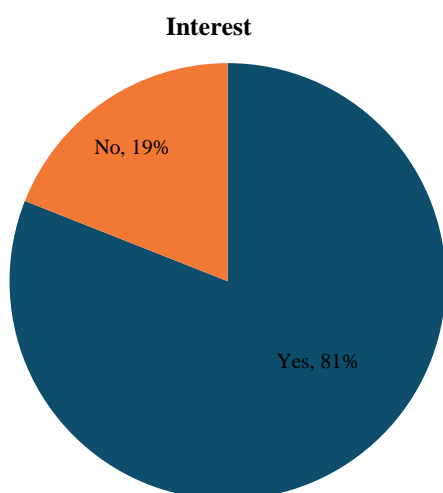
Box 4**Figure 4**

Preferences for Mexican beach destinations

Source: Own Elaboration (2025)

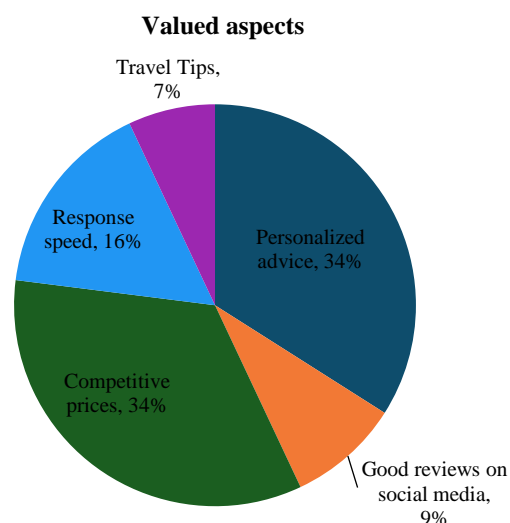
4.2 Willingness to Use Online Travel Agencies

Results related to the contracting of digital tourism services show a high willingness among users to use online travel agencies (Figure 5), as well as a sustained interest in continuing to purchase this type of service (Figure 6). This finding confirms the general acceptance of the digital model as a viable alternative to traditional travel agencies.

Box 5**Figure 5**

Interest in hiring an online travel agency

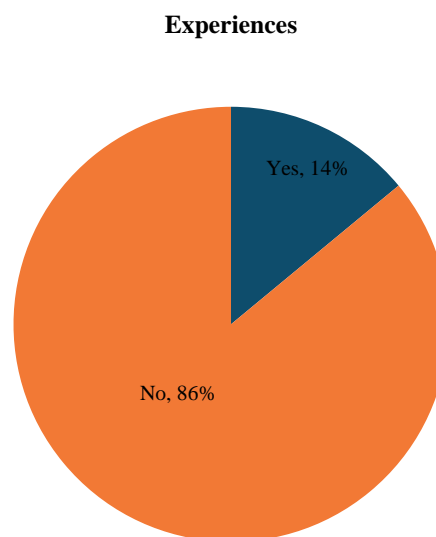
Source: Own Elaboration (2025)

Box 6**Figure 6**

Most important aspects when choosing a travel agency

Source: Own Elaboration (2025)

Nevertheless, the analysis also reveals the presence of previous negative experiences with travel agencies (Figure 7) and an underlying fear of being scammed in online purchases (Figure 8).

Box 7**Figure 7**

Most important aspects when choosing a travel agency

Source: Own Elaboration (2025)

Box 8

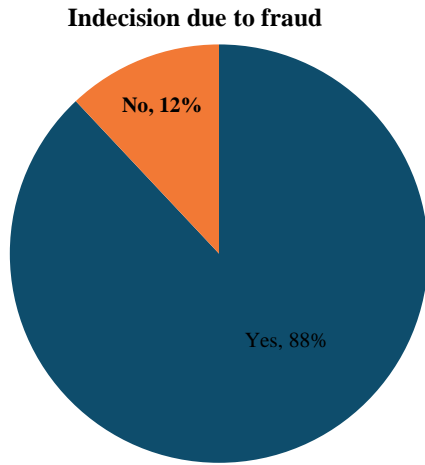


Figure 8
Fear of being scammed in online purchases
Source: Own Elaboration (2025)

These results indicate that although digital channels are widely used, trust remains a critical factor in decision-making, reinforcing the need for digital intermediation models that prioritize transparency, security, and continuous customer support.

4.3 Service Experience and Communication Channels

Regarding service experience, users express a clear preference for personalized attention and support throughout the planning and management of their trips. Figure 9 shows a high level of trust in online support, validating the feasibility of a digital intermediation model centered on close customer interaction.

Box 9

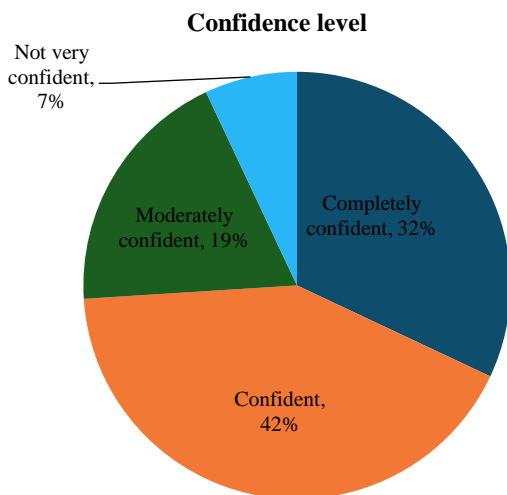


Figure 9
Level of trust in online support
Source: Own Elaboration (2025)

Regarding communication channels, the results indicate that WhatsApp is the preferred medium for interacting with an online travel agency (Figure 10), surpassing other digital channels.

Box 10

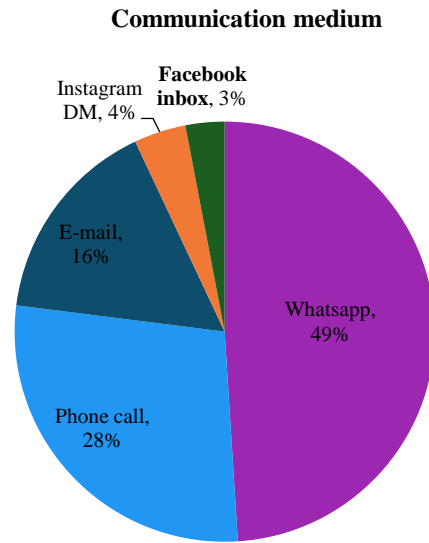
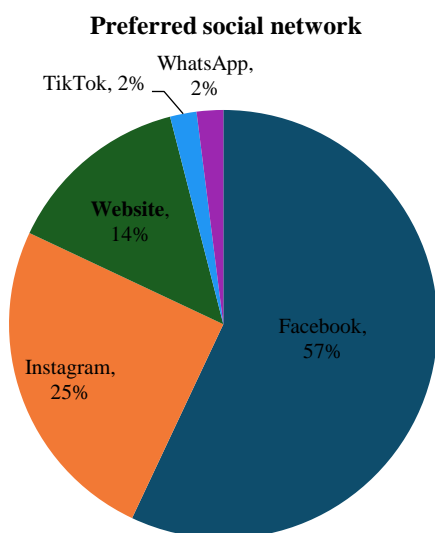


Figure 10
Preferred communication channels
Source: Own Elaboration (2025)

This finding highlights the importance of direct, immediate, and bidirectional communication as a differentiating element of the user experience and as a key factor in strengthening the agency–customer relationship.

4.4 Role of Digital Marketing and Social Media Content

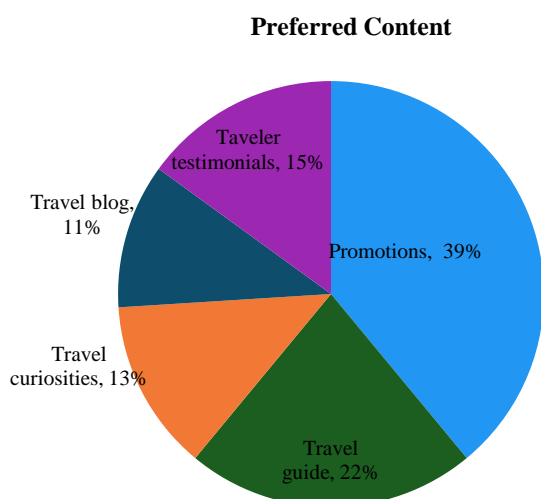
The analysis of results related to digital marketing shows that social media platforms constitute the main point of contact between travel agencies and potential customers. Facebook and Instagram are positioned as the preferred platforms for contacting an online travel agency (Figure 11), consolidating their role as strategic channels for the promotion of tourism services.

Box 11**Figure 11**

Preferred social media platforms for contacting an online travel agency

Source: Own Elaboration (2025).

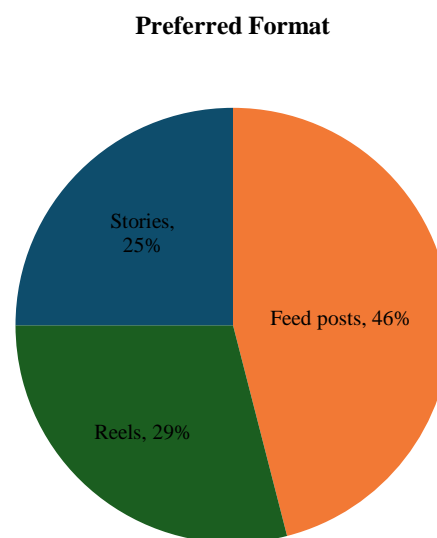
Likewise, users express a strong preference for visual, testimonial, and dynamic content—such as images, videos, and experiences shared by other travelers (Figure 12).

Box 12**Figure 12**

Facebook content preferences

Source: Own Elaboration (2025)

The preference for content formats that are easy to consume and share (Figure 13) reinforces the relevance of content marketing as a tool for generating engagement, conveying trust, and strengthening brand positioning.

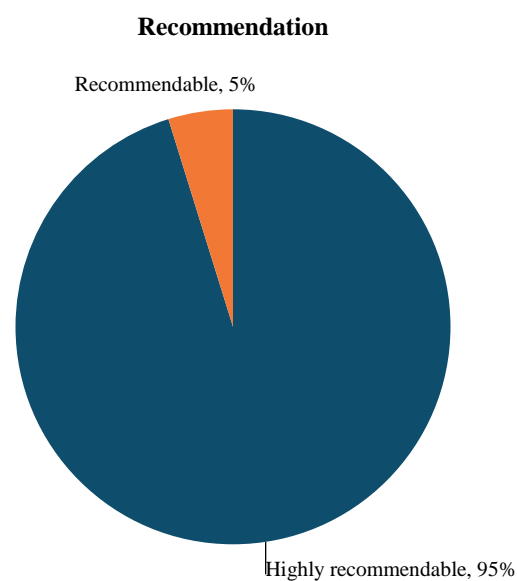
Box 13**Figure 13**

Preferred social media content formats

Source: Own Elaboration (2025)

4.5 Customer Satisfaction and Loyalty

The results obtained from the second instrument, applied to users who have already contracted services from online travel agencies, show a high likelihood of recommending the service (Figure 14, Instrument 2), reflecting favorable levels of customer satisfaction.

Box 14**Figure 14**

Likelihood of recommendation

Source: Own Elaboration (2025)

This indicator suggests that a positive user experience directly influences customer loyalty and the promotion of the service through word-of-mouth recommendations.

Likewise, the preference for real-time assistance and for clear, personalized content (Figure 15, Instrument 2) confirms that the customer experience is strengthened when continuous, timely, and needs-based digital support is provided.

Box 15

Likelihood of recommendation

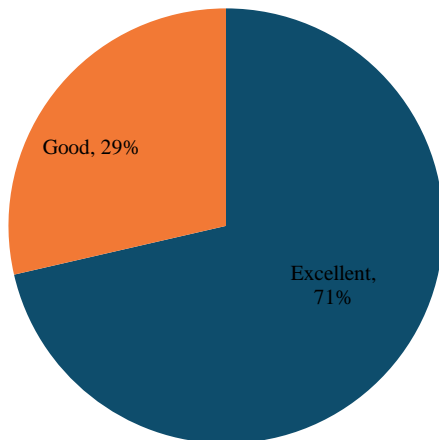


Figure 15

Likelihood of recommendation

Source: Own Elaboration (2025)

Overall, the results show that the implementation of a digital intermediation model based on service personalization, multichannel strategies, and the strategic use of content marketing significantly improves service perception, increases purchase intention, and strengthens customer loyalty in the tourism sector. These findings provide solid empirical evidence to support the proposed model and serve as a foundation for the discussion and conclusions of the study.

5. Discussion

The results obtained in the present research confirm that digital intermediation in the tourism sector not only constitutes an operational alternative to traditional models, but also represents an effective strategy for value creation, brand strengthening, and customer loyalty when integrated with a personalization- and multichannel-oriented approach. These findings are consistent with the perspectives proposed by the World Tourism Organization (OMT, 2008) which highlights the structural transformation of tourism driven by digitalization and changing consumer expectations.

The identified consumer profile—predominantly young and highly familiar with technology—aligns with previous studies indicating that young adults are the main users of digital platforms for contracting tourism services. This segment not only shows a greater willingness to use online travel agencies, but also demands personalized experiences, immediacy in service, and direct communication channels, reinforcing the need to rethink intermediation models from a user-centered perspective.

The high willingness to use online travel agencies observed in the results supports the arguments put forward by Ricart (2009) and Brzowska y Bubel (2015) with regard to the viability of electronic business models as mechanisms for expanding market reach and optimizing the value proposition. However, the persistence of fear of fraud and previous negative experiences indicates that trust remains a critical factor, as pointed out by Garrido (2023) and Bellón (2024). In this regard, the results suggest that competitive differentiation lies not solely in the use of digital platforms, but in agencies' ability to provide human support, transparency, and security throughout the purchasing process.

Likewise, the strong preference for direct communication channels, particularly WhatsApp, confirms the relevance of multichannel strategies as a strategic element of digital intermediation. This finding is consistent with the arguments proposed by Guerra (2009) and Bricio Samaniego et al. (2018), those who emphasize that social media platforms and messaging applications should not be conceived solely as promotional showcases, but rather as spaces for interaction and the construction of long-term relationships with customers.

With regard to digital marketing, the results reinforce the importance of content marketing as a strategy for generating engagement and strengthening brand trust perception. The preference for visual, testimonial, and experiential content is consistent with the trends identified by Toledo (2022), who points out that narrative and visual content constitutes one of the main drivers of interaction in digital environments. In this context, the strategic use of social media platforms such as Facebook and Instagram is consolidated as a key component for the positioning of online travel agencies.

On the other hand, the high levels of satisfaction and the strong likelihood of service recommendation observed among customers who have already used online travel agencies confirm that a positive user experience is a determining factor in customer loyalty. This finding is linked to the arguments put forward by [Núñez Cudriz y Miranda Corrales \(2020\)](#), who emphasize that the creation of superior value and the development of long-term relationships are central elements of contemporary marketing.

In summary, the discussion of the results makes it possible to affirm that digital intermediation in travel agencies becomes more effective when it is grounded in the integration of technology, personalized service, and user-centered digital marketing strategies. These elements not only respond to current trends in the tourism sector, but also contribute to the consolidation of sustainable competitive advantages, reinforcing the relevance of the model proposed in the present research.

6. Conclusions

The results obtained in this study indicate that the present research made it possible to analyze digital intermediation as a viable and effective strategy for brand growth and customer loyalty in the online travel agency sector. Through the integration of theoretical approaches from tourism studies, electronic business models, and digital marketing, the quantitative analysis showed that the digitalization of tourism services—when accompanied by personalized attention—generates measurable positive impacts on user experience and on the agency–customer relationship, as reflected in the levels of acceptance and trust reported by respondents.

The findings confirm a high willingness among consumers to contract tourism services online, with 92% of participants indicating their willingness to use digital travel agencies. This behavior is particularly significant among the young adult segment, which represents the largest proportion of users and shows a clear preference for immediacy, direct communication, and the use of social media as primary interaction channels. In this context, multichannel strategies and continuous support emerge as determining factors for model acceptance, as they respond to the expectations of the digital customer.

Likewise, the research shows that despite the widespread acceptance of digital channels, trust remains a critical element in purchase decisions.

Although 95% of respondents reported trusting digital support during the contracting process, a significant proportion also expressed fear of fraud and previous negative experiences, reinforcing the need to incorporate mechanisms of transparency, security, and personalized follow-up. These quantitative results confirm that digital intermediation based on proximity and human-centered service constitutes a competitive advantage over mass booking platforms that lack personalized support.

Regarding digital marketing, the study concludes that content marketing plays a strategic role in generating engagement and strengthening brand positioning. The data show that more than 70% of users prefer visual and testimonial content, while 55% value incentives such as discounts or gifts as factors influencing their purchase decisions.

These percentages confirm that strategies focused on creating informational and emotional value directly contribute to increasing trust and purchase intention in tourism services.

Finally, the high levels of satisfaction and the strong likelihood of recommendation identified among users who have already utilized online travel agencies allow us to conclude that a positive customer experience is a key factor in loyalty and sustained business growth. The preference for real-time assistance and direct communication channels—such as WhatsApp, used by 78% of respondents—reinforces the relevance of digital intermediation models centered on service personalization.

Overall, the quantitative findings and their analysis provide solid empirical evidence supporting the implementation of digital intermediation models oriented toward multichannel strategies, personalized service, and the strategic use of digital marketing, offering a consistent foundation for future research and informed decision-making in the tourism sector.

6.1 Recommendations

Based on the analysis of the quantitative and qualitative results obtained, as well as the critical conditions identified in the digital intermediation of tourism services, structured recommendations are proposed across four strategic levels aimed at strengthening digital intermediation models, enhancing user experience, and consolidating sustainable competitive advantages in online travel agencies.

a. Organizational Level (Travel Agencies)

- Standardize digital service and support processes by documenting service workflows, response protocols, and post-sale follow-up procedures in order to ensure consistent and reliable customer experiences. For example, systematizing customer service via WhatsApp and social media helps guarantee consistent response times and reduces perceived risk during the purchasing process.
- Strengthen personalized service as the core of the digital intermediation model by integrating real-time human support during critical stages such as quotation, booking, and incident resolution, given that 95% of users reported trust in digital support.
- Promote a customer-centered organizational culture focused on the digital consumer by encouraging continuous staff training in digital communication skills, empathy, experience management, and problem-solving, aligned with the expectations of today's tourism consumers.

b. Interinstitutional Level (Associations, Chambers, and the Education Sector)

- Promote partnerships between travel agencies, tourism chambers, and universities aimed at developing digital competencies applied to tourism, such as digital marketing, online platform management, and consumer behavior analysis. An example of this type of collaboration is the linkage between educational institutions and tourism companies to offer professional internships focused on social media management and digital customer service.

- Establish training and certification programs in digital tourism marketing to professionalize online intermediation and increase consumer trust in digital travel agencies.
- Encourage spaces for the exchange of best practices among travel agencies, facilitated by sector chambers and associations, with the aim of sharing successful experiences in service personalization, customer loyalty, and the use of digital technologies.

c. Technological Level

- Prioritize the use of accessible, customer-oriented technologies, such as instant messaging platforms, visual content management systems, and digital customer tracking tools, considering that 78% of users prefer WhatsApp as their primary communication channel.
- Develop digital repositories of tourism content, integrating testimonials, audiovisual materials, travel experiences, and frequently asked questions, to facilitate user decision-making and reinforce perceptions of trust.
- Integrate digital analytics tools to monitor key indicators such as social media engagement, satisfaction levels, repurchase intention, and likelihood of recommendation, thereby strengthening data-driven decision-making.

d. Public Policy Level

- Strengthen support programs for the digitalization of the tourism sector, specifically targeting micro and small travel agencies, with an emphasis on the adoption of digital marketing tools, e-commerce solutions, and multichannel customer service.
- Promote guidelines and certifications of best practices in digital tourism intermediation, coordinated among tourism organizations, business chambers, and regulatory authorities, to reduce perceptions of fraud and increase consumer trust.

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- Promote a national strategy for tourism digital transformation, articulated among the Ministry of Tourism, the Ministry of Economy, and the education sector, incorporating training, support, and financing for user-centered digital intermediation models.
- Ensure the continuity of support programs, avoiding exclusively short-term schemes, in order to consolidate sustainable digitalization and professionalization processes within the tourism sector.

e. Business Level

- Strengthen personalized service and digital support schemes, given that the high willingness to contract online services (92%) and the elevated level of trust in digital support (95%) indicate that users place significant value on closeness and continuous follow-up throughout the purchasing process. In this regard, travel agencies should prioritize service models that integrate real-time human assistance, especially during critical stages such as quotation, booking, and post-sale support.
- Consolidate multichannel strategies by strategically incorporating users' preferred communication channels. Considering that 78% of respondents use WhatsApp as their primary contact medium, it is advisable to integrate this platform as a formal customer service channel, complemented by social media platforms such as Facebook and Instagram, in order to ensure a fluid, immediate, and consistent communication experience.
- Reinforce digital trust and security mechanisms, addressing users' fear of fraud and previously reported negative experiences. The implementation of clear privacy policies, security certifications, verifiable testimonials, and secure payment processes can help reduce perceived risk and differentiate online travel agencies from mass booking platforms that lack personalized support.

- Prioritize the development of content marketing strategies focused on creating informational and emotional value. Given that more than 70% of users prefer visual and testimonial content, and that 55% value incentives such as discounts or gifts, travel agencies should design campaigns that integrate real traveler experiences, engaging audiovisual content, and strategic promotions that reinforce trust and purchase intention.
- Establish continuous measurement and feedback systems to monitor key indicators such as customer satisfaction, trust levels, frequency of interaction, and likelihood of recommendation. The systematic use of these indicators will facilitate data-driven decision-making and continuous improvement of the digital intermediation model.

6.2 Future Lines of Research

The analysis developed in this research shows that digital intermediation in the online travel agency sector not only represents a growing trend, but also constitutes a feasible and strategically relevant field of study for the generation of sustainable competitive advantages. The results indicate that when a customer-oriented organizational structure, a digital service culture, and the appropriate use of communication and marketing technologies are in place, digital intermediation can generate measurable impacts on user experience, customer loyalty, and brand positioning.

In general terms, the central premise of the study is validated: the articulation of service personalization, multichannel strategies, digital platforms, and content marketing approaches is a determining factor in the acceptance and effectiveness of digital intermediation models within the tourism sector. This integration makes it possible to respond more efficiently to the expectations of the digital consumer and to strengthen the agency–customer relationship.

Likewise, several critical factors that favor digital intermediation were identified, such as the intensive use of social media, instant messaging applications, visual and testimonial content, and human support throughout the purchasing process.

These elements are more clearly present among younger user segments and in agencies that have adopted structured digital strategies, suggesting a higher level of digital maturity in certain organizational profiles.

Conversely, small travel agencies and digital tourism ventures continue to face barriers related to consumer trust, process standardization, and limited adoption of analytical tools. However, the results indicate that these limitations can be overcome through personalization strategies, external partnerships, and the use of accessible digital platforms, reinforcing the need to promote inclusive intermediation models adapted to different levels of organizational development.

Based on these findings, the following lines for future research are proposed:

- Conduct longitudinal studies to evaluate the impact of digital intermediation on customer loyalty, repeat purchase behavior, and brand equity in the medium and long term.
- Analyze the effects of emerging technologies, such as generative artificial intelligence, advanced chatbots, and recommendation systems, on service personalization in tourism.
- Extend the analysis to other tourism segments, such as business tourism, medical tourism, or rural tourism, which present differentiated digital dynamics.
- Assess the role of microenterprises and digital tourism startups in informal service intermediation and in building consumer trust.
- Develop standardized performance indicators for digital intermediation, capable of being integrated into quality, marketing, or innovation models within the tourism sector.

Overall, this study contributes to both the theoretical and practical understanding of digital intermediation in real tourism contexts and opens new research agendas that recognize the technological, organizational, and relational dimensions of tourism services in the digital economy.

6.3 Final Considerations

The comprehensive analysis of digital intermediation in the online travel agency sector confirms that digital transformation does not depend exclusively on the adoption of technological tools, but rather on organizations' ability to manage the customer experience as a strategic asset. The empirical evidence obtained shows that the digitalization of tourism services is more effective when it is articulated with personalized service processes, direct communication, and user-centered marketing strategies.

The study's results reveal that the integration of digital platforms, staff competencies, a service-oriented organizational culture, and the strategic use of social media constitutes the determining factor for the success of digital intermediation models. Agencies that integrate these elements are able to strengthen consumer trust, improve the purchasing experience, and consolidate long-term relationships with their customers.

In addition, the findings confirm that multichannel strategies and continuous support are necessary conditions for developing sustainable digital intermediation models, particularly in a context where perceptions of risk associated with online transactions persist. Nevertheless, relevant challenges are also identified, such as heterogeneity in agencies' levels of digital maturity, limited process standardization, and the need to professionalize digital competencies in micro and small enterprises within the tourism sector.

The evidence presented allows us to affirm that a comprehensive digital intermediation strategy in tourism must be flexible, customer-centered, and technologically scalable, taking into account the particularities of different market segments. Such a strategy should recognize the value of human support in digital environments, strengthen staff operational capabilities, and foster organizational cultures that are open to learning and continuous improvement.

Finally, this study contributes an empirical and methodological foundation for decision-making in the field of digital tourism, providing clear elements for the design of business strategies and sectoral policies aimed at the professionalization of digital intermediation. In this sense, it outlines concrete pathways for online travel agencies to strengthen their competitiveness through the structured management of customer experience in the digital economy.

Declarations

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

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Authors' Contributions

Delgado Torres, Claudia Lizethe (First Author): Primarily responsible for the design and conceptualization of the research. Led the literature review, the development of the methodology, and the writing of the introduction and conclusions. Additionally, coordinated the data collection process and supervised all phases of the research to ensure coherence and alignment with the study objectives.

Ríos Castillo, Maricela (First Co-author): Responsible for the statistical analysis of the data. Organized the database and applied descriptive statistical techniques to interpret the findings clearly and accurately. Also collaborated in the methodological review and in the preparation of the figures presented in the study.

Villarreal Benavides, Clara Maria (Second Co-author) Responsible for the design and implementation of data collection instruments, such as the administered questionnaires. Also collaborated in the analysis of the collected data and in the interpretation of the results.

Madrigal Enríquez, Jessica Berenice (Third Co-author): Responsible for the theoretical review and support in drafting the theoretical framework. Also contributed to the final editing of the manuscript and to the verification of citations and references.

Data Availability and Materials

All data used in this research come from public and verifiable sources. PDF documents and functional links are included in the References section. Any additional requests may be addressed to the corresponding author.

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Abbreviations

ID	Intermediación Digital
OTA	Online Travel Agencies (Agencias de Viajes Online)
MD	Marketing Digital
RRSS	Redes Sociales
CX	Customer Experience (Experiencia del Cliente)

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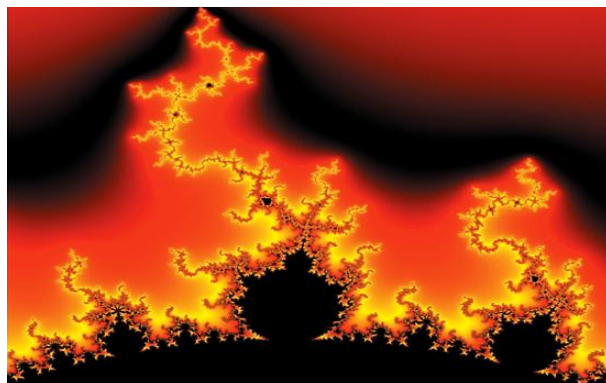


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