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Journal of Business Development Strategies

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The works must be unpublished and refer to topics of economics of research and experimental, development technology, economics consumer, behavior history of economic, thought economical, methodology resource, planning budget and, development planning and other topics related to Social Sciences.

Presentation of the Content

In *Issue 25*, is presented an article *Know-how as element of strategic management in an it solution company*, by Varela-Couoh, Andrea, Quijano-García, Román, Guillermo-Chuc, Giselle and Alcocer-Martínez, Fidel, with adscription at Universidad Autónoma de Campeche, in the next article *Compliance with transfer pricing regulations, importance of digital deliverables* by Aguilar-Pérez, Esmeralda, Irigoyen-Arroyo, Luis Ernesto and Soto-Rivas, Soledad, with adscription at Tecnológico Nacional de México Campus San Martín Texmelucan, in the next section *Analysis of the determining factors and repercussions associated with the use of social networks in SMEs: a literature review*, by Leal-Duran, Jhesica Faxuri, Cadena-Lopez, Aydé and Rivera-Gonzalez, Gibrán, with adscription at Instituto Politécnico Nacional - Unidad Profesional Interdisciplinaria de Ingeniería y Ciencias Sociales y Administrativas, in the next section *Strawberry (Fragaria L.) transportation model in Mexico for Closed Market* by Quintero-Ramírez, Juan Manuel, Omaña-Silvestre, José Miguel and García-Rico, Perla Araceli, with adscription at Consejo Nacional de Humanidades, Ciencia y Tecnología and Colegio de Postgraduados, in the next section *Digital profile of the entrepreneur: A case study of IGE-ITNL*, by Delgado-Torres, Claudia Lizethe, Delgado-Torres, Laura Patricia, Ríos-Castillo, Maricela and Hernández-Saldívar, Elisa, with adscription at Tecnológico Nacional de México/Tecnológico de Nuevo León , in the last section *Proposal of learning strategies for the subject of Quality Systems Management for Industrial Engineering, at the Technological Institute of Villahermosa*, by Sierra-Morejòn, José Luis, Javier-Gerònimo, Zinath, Morejón-Sánchez, Juana María and Abid-Becerra, Marco Antonio with adscription in Tecnológico Nacional de México Campus Villahermosa.

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Article

Know-how as element of strategic management in an it solution company

Know how como elemento de administración estratégica en una empresa de soluciones informáticas

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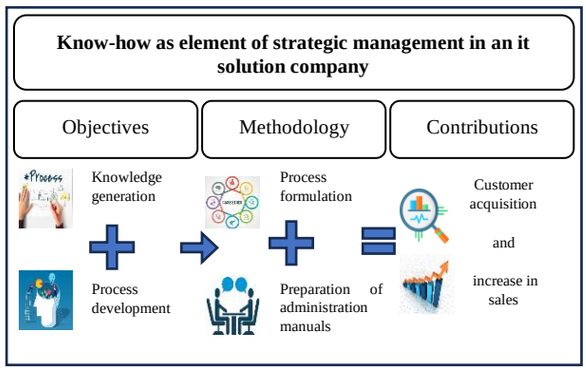
Abstract

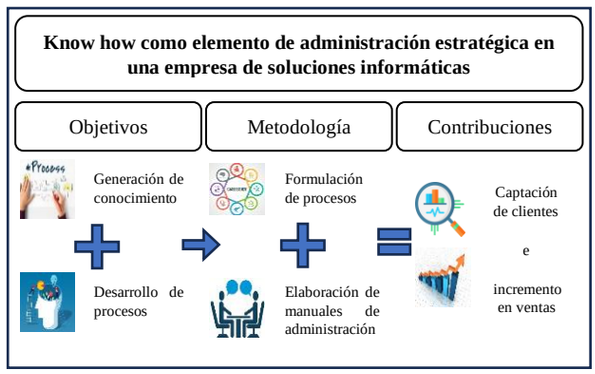
The health crisis known as COVID-19 had consequences in the personal and business environment where human beings interact and it proved, among other aspects, that organizations with established administrative documents and previous strategic planning were able to face the negative economic effects and even innovate to remain active in the economic sectors where they operate. To identify the processes developed with exclusive knowledge of the work team members aimed to increase productivity within their organization, it was developed a case method study about a MSME from the IT services field that has remained active due to the knowledge acquired and transmitted without formal management of it, the results of the intervention allow to establish the opportunity to implement the know-how of the entity to strengthen the commitment of the bond organization-collaborators and create a competitive advantage aimed to its growth based on strategic planning.



Public policies, Social program, Sustainable development

Resumen

La crisis sanitaria denominada COVID-19, tuvo consecuencias en los ámbitos personal y empresarial en los cuales se desarrollan los seres humanos y demostró, entre otros aspectos, que las organizaciones que contaban con documentos administrativos definidos y planeaciones estratégicas previas pudieron afrontar los efectos económicos negativos e incluso innovar para permanecer en los sectores económicos donde operan. Con el objetivo de identificar los procesos desarrollados mediante el conocimiento exclusivo de los integrantes del equipo de trabajo para aumentar la productividad en la organización, se estudió a través del método de caso una mipyme del sector de servicios informáticos, que ha permanecido en esta actividad por el conocimiento adquirido y transmitido sin una gestión formal del mismo; los resultados de la intervención permiten establecer la oportunidad de implementar el know-how de la entidad para fortalecer el compromiso del vínculo organización-colaboradores y generar una ventaja competitiva orientada a su crecimiento basada en la planeación estratégica.



Política pública, Programa social, Desarrollo sostenible

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Introduction

It is a reality that in a geographical area there are companies engaged in the same line of business, however, the knowledge that they apply in their value chain, i.e. the process of creating their products or services, must have two main elements.

Firstly, it must be specific knowledge for an area and/or activity and secondly, it must be exclusive to the organization, i.e. it must not be generalised knowledge that anyone could have about the activity, but it must be different from that of the competition. Therefore, Know-how is the transmission of knowledge that allows the business to maintain its identity, a standard of quality and success.

Why is know-how important? Know-how is considered an asset for the business, since it is valuable because there is no equality between companies and yes, it allows the company to make products or services more economically, quickly and attractively, creating a competitive advantage. However, the creation of this intangible asset is through experience, because it resides primarily in the thoughts of the employee. Likewise, by protecting the knowledge through procedures that formalise the activities that a person carries out through experience, if the person who accumulates all the know-how leaves one day, the company could continue to operate without losing the competitive advantage that it has generated over time.

It is worth mentioning that know-how implies investing time and resources of the organization through the employees so that they have the experience or hiring someone with external training to share their experience with the company. Also, 60% of the current employees of the organization studied have been working in the company since its foundation. Only each worker knows the degree of responsibility and authority he/she has in the micro organization.

The other members do not know the scope of each other's functions and responsibilities; consequently, if one member is absent, the enterprise has difficulties to operate smoothly, since not delimiting the functions makes decision-making difficult.

In the company in question, the lack of knowledge of the competitive advantage, the lack of recognition of functions and the inexistence of strategies to take advantage of the capacities and abilities of the collaborator and/or organization have been limiting factors in assessing the areas of opportunity that the company has over and above the competition.

Problem statement

As a result of the events of the health contingency and the administrative changes made by direct order of the majority shareholder, the team of collaborators has been operating for more than a decade through the empirical method to carry out activities and tasks in relation to operational issues, which has caused that all the knowledge acquired through experience and practice is difficult to document and communicate, since it is only in the mind of the person who has it and therefore, it is not possible to make assertive decisions and to delimit activities according to the position.

The lack of knowledge on how to manage knowledge and formalise operational processes has led to a failure to develop and standardise existing information and to maximise competitive advantages, making the organization less efficient and innovative. This impacts the organization by leading to mistakes, inefficient processes and missed opportunities, resulting in reduced productivity and increased costs, which can lead to a loss of market share.

The objectives of this research are as follows:

a) To identify the unique knowledge of team members to increase productivity in the organization.
b) To analyse the tasks and activities per job in order to avoid duplication and to favour the reduction of service delivery times.
c) Redesign business processes and share necessary information with employees upon request.
d) Document proposed changes to processes that represent an advantage in providing services that distinguish the company as part of the acquisition, safeguarding and storage of knowledge generated within the organization.

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Theoretical framework

The emergence of the modern era required a technical, objective and universal knowledge that was called Know-how, considered a tool for knowledge management and an intangible asset in organizations, becoming the axis of business (Martínez and Giraldo, 2012).

Knowledge management and its stages

Knowledge management is a fundamental process in organizations that focuses on identifying, organizing, storing and disseminating information. Through this technique, companies can leverage the collective knowledge of their staff, leading to greater operational efficiency and faster decision-making. According to Dalkir (2011), it presents a deliberate and systematic approach to ensure the full utilisation of an organization's knowledge base, the potential of individual skills, competencies, thoughts, innovations and ideas to create a more efficient and effective organization.

The success of a product or service, together with the management of knowledge, using all possible cognitive elements, enables participation in competitive processes by means of strategic instruments that facilitate correct decisions. Necessary and desirable changes in procedures must be communicated to the staff in order not to deteriorate the activities of the working group. Companies through their staff use existing knowledge, acquired through experiences from past activities, ideas and suggestions from other members of the company to make better decisions, impacting on the company's strategic plan. Within the organization it involves personnel, technology, processes and knowledge objectives established through rules, strategies and operation (Perez et al, 2013).

Knowledge acquisition can come from various external sources such as relationships with customers, suppliers, competitors and joint project partners that offer significant potential for acquiring valuable competences. Interaction with these stakeholders enables the exchange of information, experiences and perspectives, which enriches our understanding and helps us to make informed decisions.

Dalkir (2011), mentions that knowledge creation includes all those activities by which the organization seeks to develop competencies that are not already in place, or to create those that do not yet exist inside or outside the company. The understanding of things always starts with the individual, develops continuously and at all levels of the organization (in many cases in an unexpected, unplanned way). It is therefore not a sequential process, but a dynamic interaction between tacit and explicit knowledge.

Although there are no variables that determine the existing degree of development of a company in relation to knowledge management, it is possible to design a model with the objective of providing support for the analysis and variables that determine the degree of development in a company (Hernández and Sánchez, 2006). The learning base of an organization consists of the individual and collective assets that it can use to carry out its activities. Explicit knowledge allows for a certain level of operational efficiency and control, and promotes equitable and consistent structural responses (Hernández and Sánchez, 2006).

Knowledge management offers a number of benefits that contribute to growth and efficiency. According to Perozo (2005), some key reasons why a company should use and promote knowledge management are: Identification which is the process of recognising, classifying and documenting the existing knowledge assets within an organization. This process is fundamental as it provides a solid foundation for the capture, storage, transfer and effective application of knowledge. Acquisition focuses on identifying, collecting and recording relevant information that exists within the company or that comes from external sources while development involves designing and organising the information so that it is easily understood by business stakeholders (Lescay and Perez, 2009).

This involves creating knowledge management systems, databases, document repositories and other storage structures. Sharing and distribution is crucial to ensure that information and expertise is shared within the organization. This can occur through training, mentoring, project collaboration, formal and informal meetings, and other forms of communication.

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Knowledge is then perceived to have value only when it is applied to solve problems, make decisions or improve processes.

Consequently, utilisation involves identifying opportunities to use existing information effectively in the organization and turning it into concrete actions. Retention is a part of the process that focuses on preserving and storing critical knowledge for future use (Mallar, 2010).

Knowledge management in the service sector

Knowledge generation in the service sector is a strategic resource that focuses on leveraging internal and external information to improve service quality, customer satisfaction and operational efficiency. By adopting effective practices, companies can differentiate themselves in a competitive marketplace and improve their ability to adapt to changing customer demands and expectations (Arceo, 2009). When applying knowledge management to firms in this sector, there are similarities with the stages of knowledge.

Companies providing services must identify and document critical knowledge related to their processes, procedures, best practices and accumulated experience, in order to optimise efficiency and effectiveness in the delivery of their activities. To achieve this, a thorough understanding of customer needs, preferences and experiences is fundamental.

Organizations must capture and store customer knowledge, including information on their buying habits, interaction history and expectations, through customer relationship management systems, customer satisfaction surveys and data analysis (Matos, 2004).

According to Portillo and Ortega (2004), information technologies play a key role in knowledge management in the service sector.

Organizations can use computer systems, intranets, online collaboration tools and project management platforms to facilitate the capture, storage, transfer and effective application of knowledge.

Process Re-engineering and Synergy

Process-based management emerges as an approach that focuses attention on the organization's activities in order to optimise them. It will view the organization as a network of interrelated or interconnected processes, shifting the focus from structures to processes as a methodology for improving performance, concentrating on the disciplined design and careful execution of all processes in an organization (Bedoya, 2015).

Process management ensures that activities are thought, designed and executed within the framework of a process, when employees recognise that their individual activities are part of something bigger, they are aligned towards common goals. Mallar (2010), explains that its application generates the detailed analysis of processes in organizations of all types, including those providing services, which can model their way of operating, allowing to improve the management of each process and the set of processes, to optimise performance towards internal and external customers.

Any organization can be represented as a complex network of elements that perform activities that allow them to interrelate with each other to achieve the purposes of the whole; each of these interrelationships can be represented and managed as a process (Llanes et al. 2014).

Process types include strategic, operational and support processes. The key lies in achieving effective alignment between them, thus ensuring that they operate in harmony and jointly contribute to the achievement of the organization's common goals.

Process improvement has been defined as the systematic analysis of the set of interrelated activities in their flows, in order to change them to make them more effective, efficient and adaptable and thus increase the ability to meet customer requirements.

During the transformation of input variables, processes are analysed to optimise them in order to obtain output variables that create or add value to the organization (Davenport, 1990; Galloway, 2002 and Harrington, 1993).

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Process improvement is an effective way to manage an organization at any level and support the achievement of its overall objectives, and can therefore be considered a tool that enables companies to achieve efficiency and remain competitive in a constantly changing world.

In order for processes to be planned, controlled and improved, the inputs and outputs of the system, the identification of the activities that are related to achieve the desired result, the use of various resources for transformation and the search for adding value in order to fully meet the requirements of the internal or external customer must be clearly determined (Dalkir, 2011).

To maintain the dynamism of organizations and their focus on results, process-based management is advocated. A process should be seen as the sequence of steps designed to produce a product or service of value for someone external to the process; it is a set of interrelated activities that interact to transform input elements (raw materials, inputs, energy, money, information) into value-added results (products and services), useful for some customers and information for customers and other stakeholders (Acevedo and Gómez, 2015).

To improve a process, Deming's improvement cycle, known as PDCA (Plan, Do, Check, Act), must be applied. It represents a circle that underlines the constant nature of the improvement process to achieve systematic and structured problem solving, as well as to analyse the causes and provide solutions for continuous improvement (Lescay and Pérez, 2009).

Strategic Planning and Know-how

Knowledge management and strategic planning are intrinsically linked, as effective knowledge management provides the necessary basis for sound strategic planning and its successful implementation.

According to Kartajaya et al (2016), strategic planning is a tool for all types of companies, and its application seeks through an in-depth analysis of the organization and its environment, to find effective strategies that will enable it to meet its proposed objectives.

To achieve effective strategic planning, the following contexts must be analysed: the company's situation in recent years, market, competition, costs, macro-environment, owners' thinking, strategic objectives, organizational strategies and plans by work area. In order to obtain quantifiable data that lead to sound decision making (Vargas, 2018).

Currently, companies face the dilemma of having to plan for the long term and at the same time face complex and unstable scenarios, which hinders their stability and growth. In order for a business to achieve viability, it is necessary to evaluate and react to its immediate results, i.e. to use past experiences and activities as an indicator to develop conditions to optimise existing resources (Amorocho et al., 2009).

Know-how began to be a source of scientific management in the 17th century through measures, profiles, languages and techniques that make up a system.

Nowadays, businesses use this technique through the set of knowledge, skills and experience that they have accumulated over time and that has allowed them to offer a product or service with added value, which can be of a technical, operational or strategic nature (Ribeiro, 2008). Know-how or provision of technical knowledge, ‘is understood as that legal business whose object is the cession or transfer of the right to reserved technical knowledge, carried out by its owner in favour of the other party. This agreement implies the transfer of the use and exploitation of such knowledge in exchange for a counter-performance’ (Benavente, 2008). It may include trade secrets, specialised techniques or valuable information that confers a competitive advantage in the market.

Know-how enables organizations to perform certain tasks more efficiently and effectively than their competitors. Through years of experience and practice, companies can refine their internal processes, identify the best procedures and develop them to meet specific industry challenges (Ribeiro, 2008).

This knowledge not only allows them to produce goods and services at lower costs, but also gives them the ability to respond quickly to market demands and adapt to changes in the business environment.

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A competitive advantage is anything that gives a company a preponderance over its competitors, helping it to attract more customers and increase its market share. Competitiveness is a central issue in business management. Organizations are becoming aware of their value and belief systems, and are working to align them with strategic business objectives.

This alignment is crucial to direct both the company and its human resources towards sustainable growth (Velasquez, 2004). It also strengthens innovation as it allows companies to develop new ideas and products, and can help them adapt to changes in the market and new technologies. Through efficiency they can optimise their processes, reduce costs and help them make better decisions based on data and experience, allowing them to expand into new markets or develop new products, attract and retain the best talent and build a reputation for quality and reliability that will allow them to attract new customers and partners (Molina et al. 2014).

In addition, know-how can be a source of customer loyalty and brand reputation. When a company demonstrates a high level of knowledge and expertise in its field, people tend to trust it and value its products and services above the competition, (Prusak, 2001). This earned trust and reputation can translate into a loyal and satisfied user base to strengthen brand reputation, attract new buyers and help expand into new markets and segments. SME entrepreneurs should use their networking capabilities to gather information and build alliances. A personal network relies on relationships between them and other owners, suppliers, investors, friends, etc. (Molina et al, 2014).

Influence of the leader in the application of know-how

According to Robles et. al 2008, the leader can influence an organization's Know-how in several ways by creating a learning and development culture where employees feel supported and motivated to learn new skills and knowledge; this can lead to an increase in the knowledge of the organization as a whole. They can also provide development opportunities for employees, such as training, mentoring and coaching, which helps employees develop or acquire new skills and knowledge.

By modelling learning and development, leaders demonstrate to employees that learning is important and that it is something everyone should strive to do. Leaders who are open to new ideas and willing to share their knowledge can create an environment in which employees feel comfortable and lead to greater information and knowledge sharing within the organization (Delgado and Delgado, 2003). Overall, the impact of the leader on an organization's know-how is positive. Leaders who foster a culture of learning and development provide opportunities to model learning and development, helping to create an organization with a greater amount of information and knowledge.

Methodology

The objective is to present the current situation of the organization in question and the problems identified that obstruct the safeguarding, management and application of knowledge to provide a standardised service of IT solutions and that originate as a proposed solution the know-how for the administrative and operational processes that the company has implemented and that are a reflection of the knowledge generated, but not yet recognised as a competitive advantage.

The evaluated entity belongs to the service sector of electronic software solutions and equipment for business and personal use, which was analysed under the case method to illustrate situations, actions or decisions that are related to the studied topic (formalisation of knowledge management) and allows observing the operation of the organization, with the objective of providing solution alternatives that have been applied in similar situations and that were developed based on the main concepts and theories associated to the phenomenon under study (Naumes and Naumes, 2006). According to Marcelino, Baldazo and Valdés (2012), the case method seeks not only to identify the factors that affect a phenomenon, but also the detailed knowledge of these factors in the units of analysis. The methodological design used is nested and illustrative, as it presents or exemplifies the phenomenon under investigation (know-how as a competitive advantage), under a specific theoretical approach integrated by a single case (MSMEs in the IT services sector), with more than one unit of analysis: strategic management, know-how and knowledge management (Yin, 2003).

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The processes implemented for the provision of services to customers and the impact on the results in the event of a contingency resulting in the absence of the employees who develop them were evaluated.

Results of the intervention

Organizational background

Soluciones en Tecnología PC S.A. de C.V. was born 18 years ago, when a couple of brothers in 2005, decided to create a microenterprise that provided repair service and sale of electronic spare parts; with the aim of having their own source of income and to offer customers the opportunity to have a repair service in electronic equipment; where the indicators are the delivery on time and advice on technical support.

They began to offer their services located in the city of San Francisco de Campeche, with only three collaborators. Personal motivations, as well as the demand for services and the infrastructure that was insufficient to meet the needs of the work team, made them decide to move to Avenida Francisco I. Madero in 2008.

During the time they operated in that location they went through external issues to the organization, such as public infrastructure projects, carried out near the address which affected the access of customers during the years 2017 to 2019.

In March 2020, the sanitary contingency caused by COVID-19 generated new hygiene and safety measures for the operation of commercial activities, although the Business Demographics Studies (EDN, 2020) indicate that 37.8% of MSMEs in the state of Campeche did not survive the impact of the sanitary contingency (National Institute of Statistics and Geography, INEGI, 2011). Electrónica Max, the trade name under which Soluciones en Tecnología PC S.A. de C.V. is currently known, withstood and adapted to the new normality imposed on business in Mexico. Currently, Soluciones en Tecnología PC S.A. de C.V. has a staff of 10 employees trained in repair techniques and use of technological tools to solve those problems that are present in computer equipment and electronics with commitment and delivery. Despite inflation and other economic issues, the company has found a balance between its income and its fixed and variable costs.

Additionally, it has and seeks links with strategic clients such as the Autonomous University of Campeche, the Campeche State DIF System and the College of Scientific and Technological Studies of the State of Campeche. Likewise, during the year 2020 and due to the pandemic, it will venture into e-commerce through its official website and through the Mercado Libre platform as a competitive strategy to attract new customers.

Description of the problem in the entity

Since the change of location and restructuring in 2006, Soluciones en Tecnología PC S.A. de C.V. has undergone changes in its administration and commercial image. Before having the infrastructure of a two-storey building, they rented horizontally and operated individually the sale of accessories and the repair service under the same name but under a different commercial name. However, in 2008, the majority shareholder decided to operate in a matrix manner and in a single building, as the era of invoicing as it is currently known in Mexico began.

During the adaptation process, there were external inconveniences. First, the construction of the Mega-Drainage project that stretched from Avenida Héroes de Nacozari to the coast of the city. Although the construction was carried out for the improvement and benefit of the population, businesses located in the construction zone were affected because vehicular and pedestrian traffic was significantly reduced. Due to this event, they had to reduce the number of staff, as well as reduce expenses to avoid a total closure. A similar situation arose in 2017, due to the construction of the road distributor within the city.

At the beginning of 2020, as a result of the COVID-19 health contingency, all businesses without exception enter a stage during which they are not allowed to carry out operations in person. The lack of knowledge of how the pandemic would impact on work and personal life meant that Soluciones en Tecnología PC S.A. de C.V. only had a break from activities for a month; in April 2020, at the height of the pandemic and with the new provisions for carrying out face-to-face activities, they resumed work behind closed doors in order to repair, update and sell computer equipment that was in high demand by the public.

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By the end of 2020 and the beginning of 2021, a new normality begins for the organizations, therefore, and by official COPRISCAM disposition, they must invest in additional safety and hygiene equipment in order to have an approach with the clients, but preserving the healthy distance.

The contingency was a threat to business development, but for Soluciones en Tecnología PC S.A. de C.V. it was an opportunity to enter a new market such as e-commerce. However, due to the events and the high demand, the organization acquired a new vehicle to transport material required by the clients and to carry out the equipment collection service.

Being a company dedicated to the technology sector, training is carried out approximately every six months to provide new knowledge to the staff.

Analysis of the particular problem

Soluciones en Tecnología PC S.A de C.V. is a microenterprise in the municipality of Campeche, currently legally constituted as a variable capital corporation with a focus on repair services, and presents the following problem with respect to the business knowledge generated and its management:

It faces disorganization in order to adequately execute the processes to be followed in the operation of the repair service, as well as fair and unfair competition.

For this reason, it is considered necessary to create and implement manuals and files that contribute to transfer skills, techniques and knowledge for internal management, whose institutionalisation (as a business strategy) will turn it into a competitive advantage.

On the other hand, the transfer of information should be from the company to the staff and not vice versa, because if the information is provided and managed by the collaborators, there may be controversy due to the ideology that no one is indispensable, but everyone is unique and unrepeatable and no person will perform a task in the same way as another.

The standardisation and development of existing information avoids the aforementioned, and helps to enhance competitive advantages, leading the company to carry out processes in an efficient and innovative way, thus obtaining new opportunities; therefore, it increases productivity and generates a reduction in the costs of service provision. By creating a differentiator from its competitors, it can lead to a market opening and an increase in revenue.

It was evaluated whether the company has the components of the Know-how theory, considering that the elements that make up this tool influence the preservation of specialised knowledge, as well as the elaboration and standardisation of processes.

Through dialogue with the work team, they stated that, although they have some seniority in the organization, from the time they joined the workforce until the present day there are no records or files that indicate the correct way to perform tasks and activities.

A descriptive methodology was used for this research, considering that the events were studied at a single point in time within their natural context and are not subject to experimentation. Based on the conceptualisations addressed in the reference framework regarding the knowledge management - Know-how binomial, the proposed solution to the current problems of Soluciones en Tecnología PC S.A. de C.V., reflected in Figure 1, is supported.

Box 1

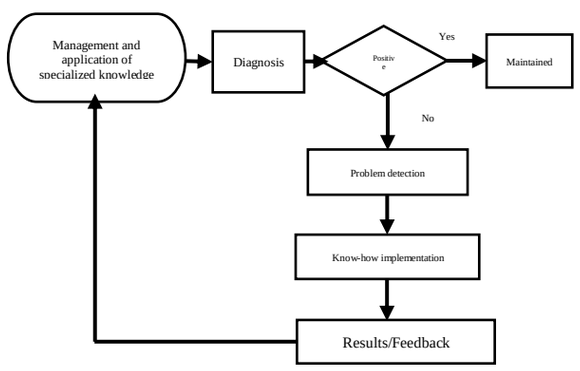

Figure 1

Current situation of Soluciones en Tecnología PC S.A. de C.V.

Own elaboration (2024)

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In addition, in order to measure the benefits of the development of know-how, indicators were developed whose results reflect the current state of the company with respect to knowledge management and the need for a proven technique that contributes to its formalisation and evolves into a competitive advantage (Table 1).

Box 2

Table 1

Organizational operational indicators with information from the 2023 financial year, prior to the implementation of the know-how

Indicator name	Formula	Replacement	Result	Interpretation
Competence development				
Recruitment	Employees selected during the period / Employees recruited during the period	4/6	0.67	The selected persons have the profile to carry out the activities of the position.
Job training	Training delivered / Training programmed	2/4	0.5	The indicator indicates whether training programmes are carried out, and gives rise to an analysis of the causes of non-compliance.
Effectiveness of training	Productivity achieved / programmed productivity	2/4	0.5	Ongoing training should be reflected in increased productivity in terms of services delivered in a timely manner.
Staff turnover	Employees at the end of the period / Employees at the beginning of the period X100	10/10	100%	Low turnover indicates that the company's working conditions foster a sense of identity, belonging and commitment among employees.
Stimulus for innovation	Incentives awarded / Incentives programmed	0/0	0	The company should consider creating an incentive programme, as it motivates and recognises the achievements of each employee..
Administrative structure				
Strategic planning	Strategies implemented / Strategies designed	0/0	0	It is advisable to plan, organise, direct and control through short, medium and long term objectives in order to obtain tangible results in the goals.
Operational formalisation	Documented processes / Implemented processes	0/0	0	Reflects the level of standardisation through documents of an organization's processes.
Process monitoring	Number of processes supervised in the month / Number of supervisions programmed	0/0	0	Indicates the level of verification of compliance of activities through effective supervision by area managers.
Time management	Number of orders executed in the period / Number of orders entered per day	6/3	2	Having training helps to reduce the time spent on service delivery, which is also reflected in productivity.

Own elaboration (2024)

The operations of Soluciones en Tecnología PC S.A. de C.V. do not have documented procedures that support specialised knowledge. As a result, when a setback arises in the provision of services, decision-making falls to the general management but is not dealt with immediately, thus limiting the participation of employees in problem-solving. It is also complicated to train new collaborators, because there is no training programme or a formal guide that serves as an induction process to the position and the functions that each worker must develop; since the knowledge is the own and empirical knowledge of each employee.

Given this need, in order to have adequate knowledge management and based on the theory of Lescay and Perez (2009), which mentions that the acquisition and development of knowledge involves the creation of management systems, databases, document repositories and other storage structures, justifies the proposal to develop a procedures manual that serves as documentary support of the know-how of employees and creates the guideline of the portfolio of indicators that measure the outcome of the operating processes. Implementing know-how as a competitive advantage through the set of knowledge and skills that are not easily accessible or imitable, allows for a more efficient and effective service and guarantees the company's intellectual property as an intangible asset (Figure 2).

Box 3

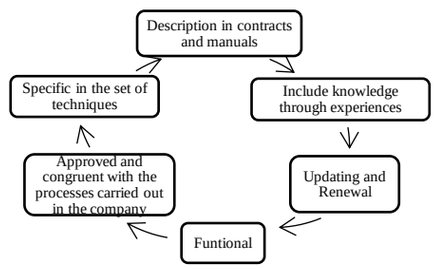

Figure 2

Schematic diagram for Know-how Implementation

Own elaboration (2024)

By having a deep knowledge of the area or activity, according to Amorocho (2009), new opportunities can be identified, creative solutions can be developed and service can be continuously improved.

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Allowing to adapt to market changes and stay at the forefront of the sector, creating a differentiator from the competition, resulting in greater opportunities for business, more satisfied customers and better profit margins, therefore, the know-how can be monetised and thus improve the reputation and position as an expert in the business line between customers and partners.

Knowledge management approaches aim to establish a clear division of tasks in each area. As Lescay and Pérez, (2009) explain, with the elaboration of the process manual, each area will have a detailed guide to carry out its daily activities. This will not only improve efficiency and communication, but also reduce risks and increase customer satisfaction.

One of the main benefits would be the standardisation of procedures to improve operational efficiency. By establishing a defined set of steps and practices for carrying out specific tasks, the company could eliminate redundancies, minimise downtime and optimise available resources.

It would also promote the delivery of consistent quality in the services offered by the company. By following standardised processes, variability in the execution of tasks is reduced, resulting in a high quality service every time.

With clear and standardised procedures to follow, new employees can more easily integrate into the company and quickly learn the tasks required to perform their duties. This speeds up the onboarding process and contributes to a more competent and productive workforce.

Despite their standardised nature, procedures can also be flexible and adaptable as business needs and circumstances change. Standardisation provides a solid foundation on which the company can make continuous adjustments and improvements to its operational processes. This fosters a culture of continuous improvement within the organization, where employees are encouraged to identify opportunities for optimisation and actively contribute to innovation and positive change. Derived from the implementation proposal, it is expected that the indicators designed in the solution proposal will have new and favourable results as a benefit of the know-how. (Table 2).

Box 4

Table 2

Indicators of organizational performance following the implementation of the know-how

Indicator name	Formula	Replacement	Result	Interpretation
Competence development				
Recruitment	Collaborators selected in the period / Collaborators recruited in the period	5/6	0.83	The selected persons have the profile to carry out the activities of the position.
Job training	Training delivered / Training programmed	3/4	0.75	The indicator indicates whether training programmes are carried out, and gives rise to an analysis of the causes of non-compliance.
Effectiveness of training	Productivity achieved / Productivity programmed X 100	4/4	100%	Ongoing training should be reflected in increased productivity in terms of services delivered in a timely manner.
Staff turnover	Employees at the end of the period / Employees at the beginning of the period X 100	10/10	100%	Low turnover indicates that the company's working conditions foster a sense of identity, belonging and commitment among employees.
Stimulus for innovation	Incentives awarded / Incentives programmed	2/4	0.5	The company should consider creating an incentive programme, as it motivates and recognises the achievements of each employee
Administrative structure				
Strategic planning	Strategies implemented / Strategies designed	2/4	0.5	It is advisable to plan, organise, direct and control through short, medium and long term objectives in order to obtain tangible results in the goals
Operational formalisation	Documented processes / Implemented processes	3/4	0.75	Reflects the level of standardisation through documents of an organization's processes.
Process monitoring	Number of processes supervised in the month / Number of supervisions programmed	3/4	0.75	Indicates the level of verification of compliance of activities through effective supervision by area managers.
Time management	Number of orders executed in the period / Number of orders entered per day X 100	6/6	100%	Training helps to reduce the time spent on service delivery, which is also reflected in productivity.

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The results of the indicators in Table 2 show that the formalisation and documentation of processes favour knowledge management and the establishment of know-how as a competitive advantage in the MSMEs involved.

Conclusions

Through the implementation of Know-how, benefits will be obtained in the acquisition, storage, dissemination and application of practical and tactical knowledge that is acquired through experience, allowing tasks to be carried out or problems to be solved efficiently, reducing customer service times.

Based on the indicators, it can be seen that this company maintains a zero staff turnover, which has a number of benefits that can contribute to standardisation and knowledge management, which in turn contributes to long-term growth and stability. By retaining staff, the company can reduce costs and allocate financial resources to more productive and strategic areas of the organization. Employees accumulate experience and knowledge about the company's products, services and processes.

Employees will also be more committed to the company's values, objectives and standards, since a stimulus programme recognises the productivity of the period and generates a sense of belonging to the company towards the employee. Therefore, by having more experience and solid knowledge, they are better able to meet the needs of customers. The possible limitations hindering the proper management of knowledge and the development of know-how in the company should not be overlooked:

I. As an MSME, the implementation of management systems and processes can be costly and requires careful planning and significant resources, both financial and human.

II. Some employees may be resistant to adopting new knowledge management tools and practices, and hinder the successful implementation of these initiatives.

III. Because it involves sharing sensitive and proprietary information within the company, it can pose security and confidentiality risks if adequate safeguards and access control measures are not put in place.

Carrying out the analysis of the proposed implementation of the Know-how, in order to identify the competitive advantages in the services offered by Soluciones en Tecnología PC S.A. de C.V. should result in the management of knowledge through standardised and previously verified processes that have an impact on decision-making for the improvement of the service offered to customers.

Declarations

Conflict of interest

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

Authors' contribution

Varela-Couoh, Andrea: Conducted the framework, fieldwork, interview administration and conclusions.

*Quijano-García, Román: P*roposed the methodology, analysis of results and conclusions.

Guillermo-Chuc, Giselle: Formulated the introduction and its elements.

Alcocer-Martínez, Fidel: Constructed the theoretical framework.

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Article

Compliance with transfer pricing regulations, importance of digital deliverables

Cumplimiento de normatividad de precios de transferencia, importancia de la estandarización de los entregables digitales

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Abstract

The standardization of digital and physical deliverables for transfer pricing compliance is relevant. Descriptive and qualitative research was used. 54.5% of the population considers the transaction process efficient, 36.4% complies and only 9.1% is dissatisfied.

Compliance with transfer pricing regulations, importance of digital deliverables		
Objectives	Methodology	Contribution
Standardize digital and physical deliverables of competent information for compliance with transfer pricing regulations.	The type of research used was descriptive and qualitative, the sample included the company's staff.	The most important results indicate that the standardization of work papers allows for compliance with transfer pricing.

Estandarización, precios de transferencia

Resumen

La estandarización de los entregables digitales y físicos para cumplimiento de precios de transferencia es relevante. Se utilizó investigación descriptiva y cualitativa. El 54.5% de la población considera eficiente el proceso de transacciones, el 36.4% da cumplimiento y solo el 9.1% está inconforme.

Cumplimiento de normatividad de precios de transferencia, importancia de los entregables digitales		
Objetivos	Metodología	Contribuciones
Estandarizar los entregables digitales y físicos de información competente para cumplimiento de normativa de precios de transferencia.	El tipo de investigación utilizada fue descriptiva y cualitativa, la muestra contempló el personal de la empresa.	Los resultados más importantes indican que la estandarización de los papeles de trabajo permite el cumplimiento de precios de transferencia.

Standardization, Tansfer Pricing

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Introduction

The standardisation of digital and physical deliverables of competent information for corporate transfer pricing compliance is of great relevance for companies. One of the strategies of Mexican corporations seeking to increase the wealth of their partners in perpetuity, both with the payment of dividends and with the increase in the value of their shares, is through high-performance teams, the application of best business practices and the standardisation of agile and simple processes that guarantee efficiency in each of their operating companies.

Corporations comprising several companies in the automotive sector must comply with the provisions of the LISR with respect to Transfer Pricing. One of the company's obligations is to create and keep all documentation proving all business transactions, such as income and deductions, in order to verify compliance with the market value. However, companies do not have this fully in place.

Risk Proper risk identification requires detailed knowledge of the company, the market in which it operates, and the surrounding legal, social, political and cultural environment. Risk identification should be systematic and start by identifying key success objectives and threats that may disrupt the achievement of these objectives.

The sources of risk are all those areas of the business, internal or external, that can generate threats of loss or impediments to the achievement of objectives. A procedure that facilitates the identification of risks is to ask, for each of the sources, whether weaknesses or threats exist in each of the sources. Risk identification should be systematic and should start by defining the objectives and scope of the industry, and then analyse the factors that are key to the business' success and review the weaknesses and threats it faces (Céspedes and Rivera, 2019).

For the analysis of the Transfer Pricing report, it is necessary to classify the risks, the objective of the risk classification is to show the identified risks in a structured way, for example, according to their origin, as shown in the following chart:

Box 1

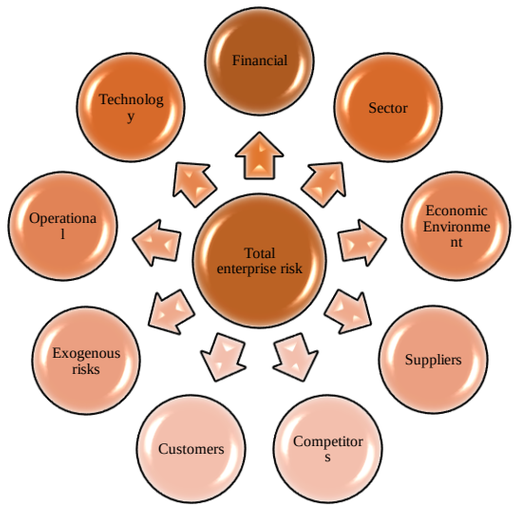

Figure 1
Ratio of total enterprise risk
Source: Tobar,2020

Box 2

Table 1
Company risks

Sector	Risk that factors external and independent of the entrepreneur's management may directly or indirectly significantly influence the achievement of the entrepreneur's objectives and strategies, e.g. changes in competition, business atomisation, market segmentation, etc.
Economic entourage	This category includes risks arising from the local or global economic environment, as well as political decisions, such as tax changes, global consumption decline, the pandemic and its impacts by sector, etc.

Source: López, Vázquez y Martínez (2023)

Sector risk

There are a large number of competitors both domestically and internationally that can satisfy customer demands in case they are not satisfied with the products distributed, however, it is one of the largest and most reliable dealers in the country.

Exchange rate risk

The organization's employees are not able to implement processes or product/service improvements fast enough to keep pace with changes in the market (consumer demands, etc.).

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However, being a large and competitive company, this can be arranged depending on the situation, however, changing a truck or a part, as well as the time cost of the same makes it risky.

Competitor risk

Due to competition in the market you may incur a cost-related competition risk.

Categorisation of entities

Entity categorisation refers to the comparison of related companies and independent parties performing similar functions within the same industry, which involves using information about the functions performed and information about the industry in order to find comparable transactions. Although the functions performed by a distribution company may vary, in general five types of distribution companies are used, this type of classification will be found in almost every industry and is important to identify as some generate higher remuneration than others.

Retailer: Owns the product; has minimal credit risk; has inventory risk; limited marketing liability is minimal; and has foreign exchange risk.

Wholesaler: Owns the product; has credit risk; has inventory risk; limited marketing liability; and may or may not have exchange rate risk.

Distributor: Owns the product; has credit risk; has inventory risk; full marketing responsibility; may or may not have an exchange rate risk; and has low supplier policy influence.

Methodology

The type of research used was descriptive and qualitative, the sample included the company's staff.

The data collection technique was a survey/questionnaire which was applied to the staff of the Treasury and Internal Audit area as it seeks to know the perspective of the procedure regarding transactions between related parties.

Therefore, open questions were developed in order to gather reliable information to contribute to the research project.

Questionnaire design

The questionnaire consisted of 18 questions applied to the departments that will be mentioned in the sample section, most of which are in charge or work on the subject directly or indirectly within the Group, the questions are of closed type in order to have consciously precise answers on the implication of policies, likewise open survey design questions are shown when the questions require more than one answer.

The Sample

The study population was considered to be group-wide, so the questionnaire was applied to Treasury and Audit staff (Coordinator, internal auditors) as well as some indirectly related staff such as Accounts Receivable and Floor Plan.

Box 3

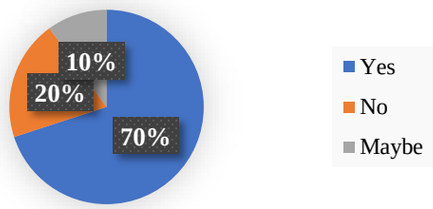

Figure 2

Does the entity have policies and procedures for inventory transactions that are applicable to all subsidiaries, affiliates and branches?

The graph shows the result of the questionnaire on the establishment of policies and procedures for transactions.

Box 4

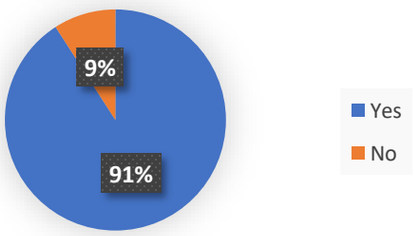

Figure 3

Is there an internal audit function or an independent third party evaluating the transfer process?

The graph shows the results of the questionnaire on the existence of auditors in charge of evaluating the transfer process.

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https://doi.org/10.35429/JBDS.2024.10.25.1.6

Box 5

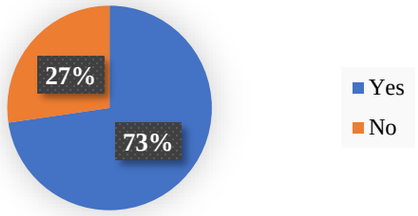

Figure 4

What type of transactions do you carry out with the related parties?

The graph shows the result of the questionnaire on the type of operation carried out with related parties.

Box 6

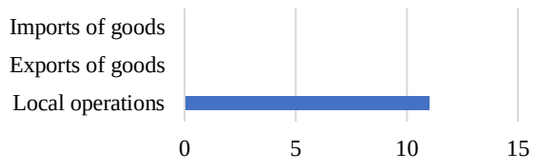

Figure 5

Does the entity have a risk assessment of its customer base and transactions?

The graph shows the result of the questionnaire on the existence of risk assessment of the customer base and transactions.

Results

The responses to the questions indicate that a legal compliance programme is in place which is regulated and overseen by a coordinator, as well as the application of policies and processes for all corporate subsidiaries.

There is record keeping and document retention relevant to compliance with the application. Most of the respondents agree that there are similarities in the policies for the purchase and sale of products with the related company, and that there is an internal audit function for the evaluation of compliance with the transfer process, complying with a legal document that covers each of the movements.

72.7% of the people surveyed agree with the statement of the existence of an evaluation of their customer base and transactions, most of them agree that a time limit is established by the suppliers for the cancellation of commercial transactions.

According to the results of the survey, the criteria applicable to account for operations are the full IFRS according to 80% of the respondents, and according to the results of the survey, the regulations related to the VAT Law (72.7%), ISR (63.6%) are used for the management of their operations, while the tax code (45.5%), labour (27.3%) and trade (18.2%) are used in the minority.

72.7% of the respondents have knowledge about the functions of the OECD, and only 27.3% were trained in transfer pricing, the majority of which 63.6% are trained in tax law.

The operation carried out with related parties is entirely local, 80% agree with the existence of credit terms granted, the highest scoring method for establishing transfer prices was the net transaction margin. 54.5% of the population considers the transaction process to be efficient and 36.4% is undecided, 9.1% disagrees. The population asserts that standardisation of deliverables for compliance with Transfer Pricing determination would be of better help.

Conclusions

The transfer pricing deliverables standardisation project required financial analysis at intra-group level, which consisted of the analysis of the monthly financial statements, assessing the degree of percentage compliance with the budget, which allows us to know the existing imbalances in the related companies and in turn implement the evaluation in order to provide solutions to them.

These are compromised from the recording of sales and expenses, which involve important spare parts for the maintenance of the asset, as well as the consideration for intra-group services with the principle of market value, so it is necessary to visualise it from the point of view of the provider and receiver.

A process has been established for the safekeeping of invoices and contracts or files referring to each sale or acquisition of goods or services, thus making an accumulation of CFDI for each concept, at the end making an accumulation by company of the totals of each movement, these are sales, expenses, transactions, financing, whether new, semi-new, spare parts.

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In this way, an analysis of interest income earned on financing received by related parties was achieved, which consisted of establishing market interest rates that allow verification of compliance with the principle of market value of effective interest rates.

During the process of reviewing the files, it was determined that most of them were financed by a third party, i.e. the financing was carried out by one of the companies belonging to the group, covering the price of the good on credit, and then making the sale to the client.

This was done as an intermediary for the completion of the sale. As well as some transfers or exchanges of vehicles between distributors belonging to the parent company.

According to the questionnaire applied, it was detected that there is a small part of the population that has been trained on the subject of transfer pricing, but that they are aware of it due to their activities in the group, so they know about the existence of the transaction process and its review by the team of auditors.

The surveyed population shares the opinion on the usefulness of standardised working papers to make transfer pricing compliance more practical.

Declarations

Conflict of interest

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

Authors' Contribution

Aguilar-Perez, Esmeralda: Contributed the project idea, development of methods and procedures. She supported the design of the field instrument. She carried out the data analysis and systematisation of results, as well as writing the article.

*Irigoyen-Arroyo, Luis Ernesto: C*ontributed to the systematisation of the background for the state of the art. He supported the design of the field instrument. He also contributed to the drafting of the article.

Soto-Rivas, Soledad: Contributed to the research design, the type of research, the approach, the method and the writing of the article.

Availability of data and materials

The information presented here was collected through a forms form, which, for use in this paper, was processed through Microsoft Excel to make the images editable.

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To the students involved with their activities (Social Service, Professional Residences and complementary credits), to give impulse to this work.

To the doctors who are collaborators of the Project and who supported the development of this article.

Abbreviations

CFDI	Comprobante Fiscal Digital por Internet
IVA	Impuesto al Valor Agregado
ISR	Impuesto Sobre la Renta
NIIF	Normas Internacionales de Información Financiera
OCDE	Organización para la Cooperación y el Desarrollo Económicos

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Antecedents

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Journal of Business Development Strategies 10[25]1-11: e31025111
Article

Analysis of the determining factors and repercussions associated with the use of social networks in SMEs: a literature review

Análisis de los factores determinantes y repercusiones asociados al uso de las redes sociales en las PYMEs: una revisión de literatura

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Abstract

Digital evolution has driven the use of social networks by small and medium-sized enterprises (SMEs). Therefore, the objective of this research is to analyze the literature supporting the enablers and barriers to the use of social networks in SMEs, as well as the benefits and risks that the use of these platforms brings to these organizations. The study uses a descriptive and qualitative methodology, reviewing 18 scientific articles that focused on the determining factors and repercussions associated with the use of these tools. The main findings reveal that low cost and ease of use were important enablers. instead, lack of resources and insufficient knowledge represented significant barriers. Benefits included financial growth and customer loyalty, while risks highlighted reputational damage and lack of profitability due to poor management.

Objectives: To analyze the literature supporting the enablers and barriers to the use of social networks in SMEs, as well as the benefits and risks, that the use of these platforms brings to these organizations.

Methodology: Descriptive and qualitative, reviewing 18 scientific articles that focused on the determining factors and repercussions associated with the use of social media in SMEs.

Contribution: Contribution to the literature on factors that favor the use of social media, barriers that inhibit its use, and benefits and risks associated with the use of social media in SMEs.

SMEs, Social media, Literature review

Resumen

La evolución digital ha impulsado el uso de las redes sociales por parte de las pequeñas y medianas empresas (PYMES), por lo cual el objetivo de esta investigación es analizar la literatura que sustenta los habilitadores y barreras de uso de las redes sociales en las Pymes, así como los beneficios y riesgos que el uso de estas plataformas trae a estas organizaciones. El estudio utiliza una metodología descriptiva y cualitativa, revisando 18 artículos científicos que centraron su atención en los factores determinantes y las repercusiones asociados al uso de estas herramientas. Los hallazgos revelan que el bajo costo, y la facilidad de uso fueron habilitadores importantes. Por el contrario, la falta de recursos y el conocimiento insuficiente representaron barreras importantes. Los beneficios incluyeron el crecimiento financiero y la fidelización de clientes, mientras que los riesgos resaltaron daño a la reputación y falta de rentabilidad debido a una gestión deficiente.

Objetivos: Analizar la literatura que sustenta los habilitadores y barreras de uso de las redes sociales en las PYMES, así como los beneficios y riesgos que el uso de estas plataformas trae a estas organizaciones.

Metodología: Descriptiva y cualitativa. Revisión de 18 artículos científicos que centraron su atención en los factores determinantes y las repercusiones

Contribución: Aporte a la literatura de: los factores que favorecen el uso de las redes sociales, barreras que inhiben su uso, y beneficios y riesgos asociados al uso de las redes sociales en las PYMES

PYMEs, Redes sociales, Revisión de literatura

Citation: Leal-Duran, Jhesica Faxuri, Cadena-Lopez, Aydé and Rivera-Gonzalez, Gibrán. [2024]. Analysis of the determining factors and repercussions associated with the use of social networks in SMEs: a literature review. Journal of Business Development Strategies. 10[25]1-11: e31025111.

Introduction

Digital transformation has changed the way organizations engage with their audience and promote their products or services. This evolution has encouraged the use of social media by small and medium-sized enterprises, emerging as a fundamental strategy in the contemporary business landscape (Kikawa et al., 2022; Fakhreldin et al., 2024).

According to Kotler et al. (2016), businesses that do not adopt these new strategies of connectivity and interaction with consumers are more likely not to survive in today's market.

Especially because nowadays consumers announce their desires to businesses through social networks, and businesses that are not there to respond to their demands are at risk of disappearing (Keke, 2022), as well as being at a disadvantage in front of the competition (Silva et al., 2022).

Different studies have shown that the use of these digital platforms offers a vast field of opportunities for small and medium-sized enterprises, including obtaining new customers, increasing profitability and direct interaction with customers (Gunawardane et al., 2022; Rendón et al., 2022; Hernández et al., 2022; Wibawa et al., 2022; Bruce et al., 2023), community building (Hassan & Shahzad, 2022; Mera et al., 2022; Terán, 2023), increasing visibility and reach, and accessing new markets (Solomon et al., 2024; Cao & Weerawardena, 2023; Bermeo et al., 2022).

On the other hand, different studies highlight that the use of social networks is given by the perception of profitability and ease of use (Hassan & Shahzad, 2022; Boada, 2022; Rendón et al., 2022; Singh, 2024), the company's knowledge of social networks (Rooshdhani et al., 2023; Cao & Weerawardena, 2023) and their low cost (Gunawardane et al., 2022; Terán, 2023).

The literature also presents us with some barriers that hinder the use of social networks, some are mentioned; lack of knowledge about these platforms and limited resources for their use (Cvjetković, 2022; Valdez et al. 2023; Singh, 2024), difficulty in creating content (Virglerová et al. 2022) and not having a clear strategy for use (Haque et al., 2024; Wibawa et al., 2022).

Moreover, not everything is positive when it comes to using social networks for marketing purposes in companies, as their inappropriate use can cause damage to the reputation of the organization and a lack of perceived profitability for their use (Terán, 2023). It is important to highlight that although social networks bring extensive benefits to companies if they are managed properly, their improper management can put them at risk. It can be determined that the literature analysed has provided a better understanding of the determinants and repercussions of the use of social networks in companies, in isolation and in different contexts. On the other hand, although there are literature reviews on the subject, there are few publications of this type that bring together a review of this phenomenon in the last two years.

Therefore, it is important to conduct a literature review that compiles in a single document the enablers and barriers to the use of social networks in small and medium-sized enterprises. In addition, the benefits and risks that these platforms bring to businesses should be considered. This is the aim of this paper. It is also considered fundamental that such a review be carried out by gathering publications on the phenomenon from 2022 to date; in order to generate new lines of research on the topic in a post-covid scenario, given that the use of social networks increased as a response to the pandemic, in order to face such social and economic crisis (Silva et al., 2022; Bermeo et al., 2022).

Therefore, it is important to conduct a literature review that compiles in a single paper the enablers and barriers to the use of social media in small and medium-sized enterprises. In addition, the benefits and risks that these platforms bring to businesses should be considered. This is the aim of this paper.

The above allows the following research question to be formulated: What are the determinants and impacts associated with the use of social networks in SMEs?

Brief description of the sections of the article. The introduction section presents a general explanation of the topic and highlights the importance of the study as well as the problem and the research question, followed by the methodology used to conduct the literature review.

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This is followed by the results, a descriptive analysis of the articles selected for the review, a table summarising the enablers, barriers, benefits and risks identified in the literature and finally the conclusions of the study.

Methodology

This qualitative research, focused on a literature review on the determinants and repercussions associated with the use of social networks in SMEs, takes an inductive approach, in order to conduct a descriptive analysis of the phenomenon. Qualitative research focuses on understanding social phenomena through the analysis of non-numerical data, allowing a deep understanding of the topics of study (Alvarez & Jurgenson, 2003), while the inductive method of analysis allows observation and experimentation of a particular phenomenon to reach a general conclusion, from the particular to the global (Creswell & Creswell, 2018).

For data collection, a search for scientific articles on the factors that facilitate or hinder the use of social networks in SMEs, as well as the benefits and risks they bring to these organizations was carried out. Academic databases were used for the literature review, such as EBSCO, Science Direct, Web of Science, Scopus, Scielo, Google Scholar, Redalyc, among others.

The search was conducted by filtering articles related to the topic, published from 2022 to 2024. This reduced the number of articles in Spanish, given that there were not many publications on these dates, but the search in English generated ample results.

After being in each of the information databases, combinations were made with different words both in English (Social media, use, SMES, benefits, repercussions, enablers, barriers, risks, impact) and in Spanish (Redes sociales, uso, PYMES, beneficios, barreras, riesgos, habilitadores, riesgos, impacto). As the search results were returned, a year filter was generated (2022, 2023 and 2024) to narrow down the information to these dates. The articles were then organised in order of relevance and the summary of each article was read to discard those that were not studies in SMEs, then those that did not mention use enablers or positive consequences of use or risks of use or barriers to use or impact.

Finally, from a total of 35 publications, those that did not meet the above-mentioned criteria were discarded and a total of 18 articles, 5 of them in Spanish and 13 in English, were used.

Finally, the data were analysed qualitatively, extracting from each of the articles the determining factors in the use of social networks, as well as the repercussions of their use in SMEs, in order to subsequently create a descriptive table of the selected publications and finally present another table summarising the enablers, barriers, benefits and risks extracted from the literature.

Results

This section presents a descriptive analysis of the 18 selected articles, detailing their main characteristics (year, type of publication, country, type of research, methodology, platforms, and subject matter) through tables and figures. Subsequently, the determinants (enablers and barriers) and impacts (benefits and risks) associated with the use of social networks in SMEs, identified in the literature reviewed, are presented, systematising this information to facilitate its understanding and interpretation.

Descriptive analysis of the selected articles

Once the search phase was completed and the 18 selected articles had been analysed, a table was created to present the main characteristics of each of the publications.

Table 1 shows a brief description that includes the title, the year, the type of publication, the country where the study was carried out, the type of research, the digital platforms analysed and the thematic category developed in each article

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Box 1

Table 1

Characteristics of the selected articles

N	Title	Year	Type of publication	Country	Type of research	Red social	Topic category
1	Social networks in SMEs and their impact on profitability	2023	Journal of Economic and Social Science Research	Ecuador	Cualitative	Facebook, Instagram, Twitter	Impact and Use
2	Digital marketing and social media for SME positioning and business entrepreneurship	2022	Magazine spaces	Ecuador	Cualitative	Facebook, Instagram, LinkedIn, Snapchat, Twitter	Impact and Use
3	Digital presence in MSMEs with a physical establishment in Mexico	2023	Revista venezolana de Gerencia. Faculty of Economic and Social Sciences	Mexico	Cuantitative	Facebook e Instagram	Estrategy
4	Social Networks and their influence on microenterprise development: the case of Loja, Ecuador.	2022	Sur Academia: Academic-Research Journal Of The Faculty Of Law, Social Sciences And Administration	Ecuador	Cuantitative	Facebook, Google+, YouTube Twitter, Instagram, Tumblr, TikTok, LinkedIn, Twitch, Telegram, WhatsApp	Effectiveness and Influence
5	Utilization of social media and its impact on marketing performance: a case study of smes In Indonesia	2022	International Journal of Business and Society,	Indonesia	Cualitativo	WhatsApp, Instagram, Facebook, YouTube	Impact and Use
6	Drivers of social media use among SMEs and its impact on brand awareness and customer engagement	2024	Asia-Pacific Journal of Business Administration	Jordania	Cuantitative	Sin Especificar	Habilitador
7	From likes to sales: study on enhancing social Media performance for Indonesian smes	2023	International Journal of Business and Society	Indonesia	Cuantitative	Sin Especificar	Estrategia
8	The impact of social media Use on the Internationalisation of smes	2022	Interdisciplinary Approach to Economics and Sociology	Polonia, República Checa, Eslovaquia y Hungría	Cuantitative	Sin Especificar	Impact and Use
9	The Impact of Social Media Usage on Small and Micro Social Commerce Enterprises in Malaysia	2022	Pakistan Journal of Commerce and Social Sciences	Malasia	Cuantitative	Sin Especificar	Impact and Use
10	Analysing the factors that influence social media adoption among SMEs in developing countries	2023	Journal of International Entrepreneurship	Kenia y Nigeria	Cuantitative	Facebook, Twitter, YouTube, Instagram, WhatsApp	Enabler
11	Impact of social media on business performance: with reference to small and medium enterprises, Western Province, Sri Lanka	2022	Sri Lanka Journal of Social Sciences	Provincia Sri Lanka	Cuantitative	Sin Especificar	Impact and Use
12	A Structural Path Analysis Bangladeshi SMEs' Sustainability through Social Media Marketing	2024	Business Innovation and Sustainability through Internet of Things	Bangladés	Cuantitative	Sin Especificar	Effectiveness and Influence
13	Organizational use and adoption of social media through toe framework: empirical research on croatian small and medium-sized enterprises	2023	Management: Journal of Contemporary Management Issues	Croacia	Cuantitative	Facebook, Instagram, LinkedIn, YouTube, Google+	Barriers
14	Social media integration: An opportunity for SMEs sustainability	2023	Cogent Business & Management	Ghana	Cuantitative	Facebook, Instagram, LinkedIn, Twitter	Estrategy
15	Social media usage and innovation performance: the case of fashion SMEs in Jordan	2022	International Journal of Fashion Design, Technology and Education	Jordania	Cuantitative	Facebook e Instagram	Impact and Use
16	Social Media Use, Organizational Performance and Sustainability: Insights from Small and Medium Enterprises in the Philippines	2022	7th International Conference on Business and Industrial Research	Filipinas	Cuantitative	Facebook, Instagram, YouTube	Impact and Use
17	Strategic use of social media in marketing and financial performance: The B2B SME context	2023	Industrial Marketing Management	Reino unido	Cuantitative	Facebook, LinkedIn, Twitter, YouTube, Snapchat, Instagram	Impact and Use
18	Perceptual factors in the use of digital marketing in small and medium-sized companies	2022	Cuadernos Latinoamericanos de Administración	Colombia	Cualitative	Facebook, Twitter, Instagram, WhatsApp	Enabler

Source: own elaboration

Year of publications reviewed

The articles reviewed cover publications from 2022 to 2024, as this was the date range selected to review the literature related to the phenomenon under investigation.

According to figure 1, the year with the highest number of publications is 2022.

Box 2

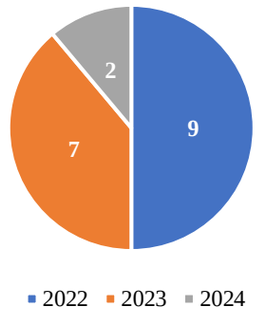

Figure 1

Year of publication

Country where the study was carried out

With regard to the regions where the studies were carried out, several continents stand out. In Asia, the countries involved were Bangladesh, Indonesia, Jordan, Malaysia, Philippines, Philippines and Sri Lanka. In Europe, the studies were carried out in Croatia, the United Kingdom, Poland, the Czech Republic, Slovakia and Hungary. In Latin America, the participating countries **were Ecuador, Colombia and** Mexico. On the African continent, studies were conducted in Ghana, Kenya and Nigeria. Figure 2 presents this detailed ranking by country.

Box 3

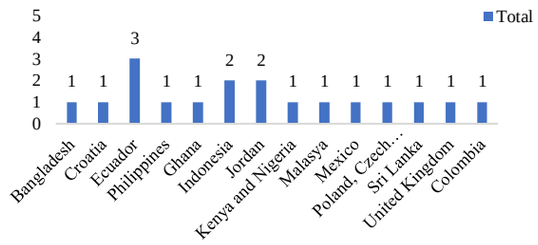

Figure 2

Publications by country

Type of article research

With regard to the type of research, it can be seen that quantitative studies (13) predominated over qualitative studies (5), as shown in Figure 3

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Box 4

Figure 3

Publications by type of research

Digital platforms analysed in the articles

In the publications reviewed, the most studied social networks were Facebook and Instagram, mentioned in 12 articles. In contrast, Twitch, Telegram, TikTok and Tumblr were the least mentioned platforms, appearing in only one article each. This analysis is reflected in figure 4.

Box 5

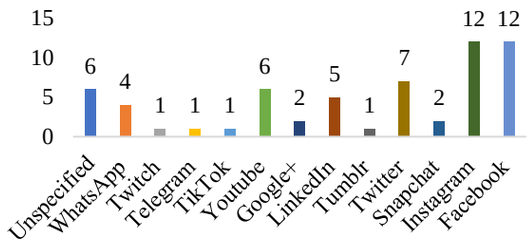

Figure 4

Social networks mentioned in the publications

Main themes developed in the articles

The articles analysed focused mainly on the following themes: impact and use, which was addressed in 9 articles; enablers and strategy, each discussed in 3 articles; effectiveness and influence, present in 2 articles; and barriers, which were explored in 1 article. This is illustrated in figure 5

Box 6

Figure 5

Theme of the articles

Determinants and impacts associated with the use of social media in SMEs

The findings of this paper present the determinants (enablers and barriers) and impacts (benefits and risks) of social media use in small and medium-sized enterprises. Table 2 presents these elements found in the literature review

Box 7

Table 2

Determinants and impacts found in the literature

Item	Elements	Authors
Enablers	Low Cost	Gunawardane et al. (2022), Mera et al. (2022), Terán (2023), Boada (2022), Wibawa et al. (2022)
	Knowledge	Haque et al. (2024), Rooshdhani et al. (2023), Cao & Weerawardena (2023), Solomon et al. (2024)
	Availability of Tools	Alkhasoneh et al. (2024), Terán (2023), Cvjetković (2022)
	Being at the forefront	Rendón et al. (2022)
	Ease of Use	Alkhasoneh et al. (2024), Hassan & Shahzad (2022), Rendón et al. (2022), Terán (2023), Boada (2022), Bruce et al. (2023), Hernández et al. (2022)
	Young Demographic Group	Boada (2022)
	Social Influence	Alkhasoneh et al. (2024), Valdez et al. (2023), Cvjetković (2022), Hernández et al. (2022)
	Positive perception	Haque et al. (2024), Hassan & Shahzad (2022), Rendón et al. (2022), Boada (2022), Cvjetković (2022), Bruce et al. (2023), Wibawa et al. (2022)
	Segmentation	Mera et al. (2022), Terán (2023)
Barriers	Lack of Management Support	Gunawardane et al. (2022), Ammar (2022)
	Absence of Impact on Internationalisation	Virglerová et al. (2022)
	Lack of Knowledge	Gunawardane et al. (2022), Valdez et al. (2023), Terán (2023), Cvjetković (2022), Cao & Weerawardena (2023)
	Lack of Strategy	Virglerová et al. (2022), Terán (2023)
	Lack of interest	Hernández et al. (2022)
	Lack of resources	Gunawardane et al. (2022), Valdez et al. (2023), Terán (2023), Boada (2022), Cvjetković (2022), Bruce et al. (2023), Wibawa et al. (2022), Cao & Weerawardena (2023)
	Perception of Difficulty	Haque et al. (2024), Wibawa et al. (2022)
	Company size and age	Virglerová et al. (2022), Ammar (2022), Solomon et al. (2024)
Benefits	Financial Growth	Gunawardane et al. (2022), Haque et al. (2024), Hassan & Shahzad (2022), Mera et al. (2022), Rendón et al. (2022), Rooshdhani et al. (2023), Valdez et al. (2023), Terán (2023), Boada (2022), Bruce et al. (2023), Wibawa et al. (2022), Cao & Weerawardena (2023), Solomon et al. (2024), Hernández et al. (2022)
	Loyalty	Hassan & Shahzad (2022), Mera et al. (2022), Terán (2023), Wibawa et al. (2022)
	Increased Market Reach	Gunawardane et al. (2022), Mera et al. (2022), Rendón et al. (2022), Valdez et al. (2023), Terán (2023), Boada (2022), Wibawa et al. (2022), Cao & Weerawardena (2023), Solomon et al. (2024), Hernández et al. (2022)
	Increased Market Knowledge	Mera et al. (2022), Wibawa et al. (2022), Hernández et al. (2022)
	Increased Innovation	Gunawardane et al. (2022), Bruce et al. (2023), Ammar (2022), (Hernández et al. (2022)
	Improved Work Performance	Ammar (2022), Hernández et al. (2022)
	Improvements in Customer Management	Alkhasoneh et al. (2024), Gunawardane et al. (2022), Mera et al. (2022), Rendón et al. (2022), Rooshdhani et al. (2023), Valdez et al. (2023), Terán (2023), Boada (2022), Bruce et al. (2023), Wibawa et al. (2022), Ammar (2022), Hernández et al. (2022)
	Brand positioning	Rendón et al. (2022), Rooshdhani et al. (2023), Valdez et al. (2023), Terán (2023), Boada (2022), Wibawa et al. (2022), Cao & Weerawardena (2023), Hernández et al. (2022)
	Sustainability Promotion	Haque et al. (2024), Bruce et al. (2023), Hernández et al. (2022)
Risks	Reputational Damage	Terán (2023)
	Dependence on Social Media	Terán (2023)
	Lack of Profitability through Inappropriate Use	Terán (2023)

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Enablers

In this paper, enablers will be defined as elements, resources or conditions that facilitate or encourage the use of social networks, being essential to achieve an effective adoption and optimal use of these platforms. Based on the analysis of the selected literature, several enablers associated with the use of social media in SMEs were identified as follows: low cost, knowledge, availability of tools, being on the cutting edge, ease of use, external training, young demographic, social influence, positive perception and segmentation.

First, *low cost* is a key enabler. Unlike traditional media, social networks offer much cheaper options for reaching customers. According to information collected in different articles (Gunawardane et al., 2022; Mera et al., 2022; Terán, 2023; Boada, 2022; Wibawa et al., 2022), the low cost of these digital platforms is one of the motivators that drives companies to use them in their marketing strategy, because the use of most of their functionalities is free and accessible to companies of different sizes.

In addition, *knowledge* refers to the skills that the company possesses to understand and become familiar with the management and use of social networks. According to different authors (Haque et al., 2024; Rooshdhani et al., 2023; Cao & Weerawardena, 2023; Solomon et al., 2024), organizations with previous experience in the use of other technologies or knowledge in marketing strategies perceive this as a factor that facilitates the use of these social tools.

On the other hand, *the availability of tools* emphasises the need to have the right human resources, the right technological infrastructure and, above all, the availability of time for management.

For companies, it is essential to have specialised staff dedicated to the management of social networks, as well as the necessary digital tools for their proper administration (Alkhasoneh et al., 2024; Terán, 2023; Cvjetković, 2022).

Likewise, *being at the forefront* implies the quest to embrace new online trends and to be part of the digital age, where one has access to a wide audience.

Companies' desire to be present and active in different social networks is driven by the need to reinforce their brand image and interact with potential customers online (Rendón et al., 2022).

Another important enabler is *ease of use*. Social networks are easy-to-use platforms that are easy to use and integrate into companies' business operations. According to the articles reviewed (Alkhasoneh et al., 2024; Hassan & Shahzad, 2022; Rendón et al., 2022; Terán, 2023; Boada, 2022; Bruce et al., 2023; Hernández et al., 2022), companies emphasise that these platforms require minimal technological resources to manage.

External training also plays a relevant role; according to Haque et al. (2024), in their study 'A Structural Path Analysis Bangladeshi SMEs' Sustainability through Social Media Marketing', the existence of government trainings and educational programmes on digital marketing is a motivator for the use of social media in business.

In addition, the *young demographic* is considered an enabler, as a study conducted in the city of Loja, Ecuador (Gunawardane et al., 2022; Ammar, 2022), highlights that age is a determining factor for the use of digital tools. This is because young people tend to be more familiar and comfortable with the use of these platforms (Boada, 2022).

Likewise, *social influence* refers to the wide penetration of social networks among the public, resulting in a strong consumer demand for businesses to have an online presence. These factors drive entrepreneurs to use digital marketing tools (Alkhasoneh et al., 2024; Valdez et al., 2023; Cvjetković, 2022; Hernández et al., 2022).

Positive perception also acts as an enabler of social network use. According to the collected literature (Haque et al., 2024; Hassan & Shahzad, 2022; Rendón et al., 2022; Boada, 2022; Cvjetković, 2022; Bruce et al., 2023; Wibawa et al., 2022), high public acceptance, perceived cost reduction and performance expectations from the use of these tools encourage their adoption and use.

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Finally, *Targeting* is perceived as a motivator for the use of social networks by allowing audience segmentation to target messages and advertising campaigns more effectively (Mera et al., 2022; Terán, 2023).

Barriers

Barriers to the use of social networks by businesses are those obstacles or restrictions that hinder or hinder the effective adoption and full use of these platforms in the business environment. According to literature analysis, the following barriers were identified as inhibiting the use of social media in SMEs: lack of management support, lack of impact on internationalisation, lack of knowledge, lack of strategy, lack of interest, lack of resources, perceived difficulty, and size and age of the company.

Firstly, the *lack of management support* is a factor that hinders the use of social networks in SMEs, due to the indifference of the owners or managers towards them. The interest shown by management in these digital platforms is crucial to enable companies to use them in their digital marketing strategies (Gunawardane et al., 2022; Ammar, 2022).

On the other hand, the *lack of impact on internationalisation* is another significant impediment. According to the study by Virglerová et al. (2022), conducted in four European countries, it was concluded that social networks do not generate an impact on internationalisation, which is perceived as a constraint for their adoption and use, especially in those companies where reaching an international market is fundamental

.

In addition, *lack of knowledge* is a major barrier. Using social media requires specific skills and knowledge about the platforms and the marketing strategies that can be developed through them. Not having this knowledge becomes an obstacle for SMEs to use them effectively (Gunawardane et al., 2022; Valdez et al., 2023; Terán, 2023; Cvjetković, 2022; Cao & Weerawardena, 2023).

Likewise, *lack of strategy and interest* is another factor preventing the use of social networks.

This is related to the lack of a clear strategy on how to use them and the lack of knowledge of the benefits that their implementation would bring to the company (Virglerová et al., 2022; Terán, 2023).

On the other hand, the lack of interest in developing a digital presence also acts as an inhibitor for the use of these tools in SMEs (Hernandez et al., 2022).

Lack of resources is also a barrier mentioned. Some SMEs argue that they do not use social networks due to lack of financial resources, specialised staff and sufficient time to learn how to use and manage them on a daily basis (Gunawardane et al., 2022; Valdez et al., 2023; Terán, 2023; Boada, 2022; Cvjetković, 2022; Bruce et al., 2023; Wibawa et al., 2022; Cao & Weerawardena, 2023).

Additionally, *the perception of difficulty* is another significant barrier. According to the literature (Haque et al., 2024; Wibawa et al., 2022), SMEs find it difficult to manage and monitor social networks, as content creation and audience segmentation require skills and time, resources that are often not available to small businesses.

Finally, *the size and age of the company* play a role in the use of social media. According to Virglerová et al. (2022), Ammar (2022) and Solomon et al. (2024), younger and smaller companies tend to use social media, in contrast to larger and older companies, which tend to be more accustomed to traditional marketing and do not see the use of these tools as indispensable.

Benefits

The use of social media in SMEs offers several benefits, which refer to the advantages derived from its proper management. These benefits have a significant influence on the success and viability of organizations in the digital age.

The main benefits identified in the literature are: Financial growth, loyalty, increased market reach, increased market awareness, increased innovation, improved job performance, improved customer management, brand positioning and promotion of sustainability.

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First and foremost, *financial growth* is a key benefit. The use of social media in SMEs generates new business opportunities and improves the performance of these organizations, which translates into higher performance and market positioning (Gunawardane et al., 2022; Haque et al., 2024; Hassan & Shahzad, 2022; Mera et al., 2022; Rendón et al., 2022; Rooshdhani et al., 2023; Valdez et al., 2023; Terán, 2023; Boada, 2022; Bruce et al., 2023; Wibawa et al., 2022; Cao & Weerawardena, 2023; Solomon et al., 2024; Hernández et al., 2022).

Customer loyalty is another key benefit. The literature indicates that building online communities and strengthening customer relationships directly result from the appropriate use of social media (Hassan & Shahzad, 2022; Mera et al., 2022; Terán, 2023; Wibawa et al., 2022).

In addition, *increased market reach* is another significant benefit. Companies that manage social media well achieve greater visibility, reach new markets and grow in existing markets.

This is because the viral nature of social media significantly amplifies the reach of marketing campaigns (Gunawardane et al., 2022; Mera et al., 2022; Rendón et al., 2022; Valdez et al., 2023; Terán, 2023; Boada, 2022; Wibawa et al., 2022; Cao & Weerawardena, 2023; Solomon et al., 2024; Hernández et al., 2022).

With respect to *market knowledge and innovation*, companies, thanks to their digital presence, can know in real time the needs of their customers and respond immediately (Mera et al., 2022; Wibawa et al., 2022; Hernández et al., 2022), which drives constant innovation to meet demand (Gunawardane et al., 2022; Bruce et al., 2023; Ammar, 2022; Hernández et al., 2022).

Improved job performance is also relevant. Ammar (2022) and Hernández et al. (2022) point out that the internal use of social networks in organizations increases productivity and work performance, fostering creativity and the rapid dissemination of knowledge among collaborators.

In terms of *customer management*, direct interaction through social networks allows efficient and fast communication, resulting in loyalty and interaction with potential customers (Alkhasoneh et al., 2024; Gunawardane et al., 2022; Mera et al., 2022; Rendón et al., 2022; Rooshdhani et al., 2023; Valdez et al., 2023; Terán, 2023; Boada, 2022; Bruce et al., 2023; Wibawa et al., 2022; Ammar, 2022; Hernández et al., 2022).

Finally, *brand positioning* is strengthened. According to studies in the literature (Rendón et al., 2022; Rooshdhani et al., 2023; Valdez et al., 2023; Terán, 2023; Boada, 2022; Wibawa et al., 2022; Cao & Weerawardena, 2023; Hernández et al., 2022), proper social media management contributes to building a positive image, enhances the brand and facilitates further expansion.

Finally, *the promotion of sustainability* occurs through the use of social media, as it encourages the formation of alliances with socially responsible companies and facilitates the adoption of sustainability best practices in the economic sector in which they operate (Haque et al., 2024; Bruce et al., 2023; Hernández et al., 2022).

Risks

Despite the many benefits of using social media in business, there are also a number of risks that can affect a company's reputation and growth. The literature identified three risks that businesses face when having an online presence: reputational damage, dependence on social networks and lack of profitability due to inappropriate use.

Lack of profitability due to inappropriate use, reputational damage, dependence on social networks. In his article 'Redes sociales en las pymes y su incidencia en la rentabilidad,' Terán (2023) explores these three risks associated with the use of social networks. He highlights that inappropriate use not only prevents the networks from generating profitability for the organization, but can also compromise the company's image and credibility. In addition, Terán points out the danger of SMEs becoming dependent on social media for their marketing strategies, neglecting traditional marketing and face-to-face customers.

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Conclusions

This literature review examined the determinants and impacts associated with the use of social media in small and medium-sized enterprises (SMEs) from 2022 to 2024. The analysis of 18 articles identified the enablers, benefits and risks influencing the adoption and outcomes of social media use by SMEs.

Key enablers included low cost, prior knowledge of social media platforms, available tools, and a desire to keep up with digital trends. In addition, a young demographic, social influence, positive perception of social media, and effective targeting strategies also encouraged their use. On the other hand, significant barriers included lack of management support, limited impact on internationalisation efforts, insufficient knowledge, lack of a clear strategy, lack of interest, resource constraints, perceived difficulty and company size/age.

The benefits of successful use of social media were correlated with increased financial growth, customer loyalty, expanded market reach, incentivised innovation, improved employee performance, better customer relationship management, improved brand positioning and promotion of sustainable practices. However, risks such as reputational damage, over-reliance on social media channels and lack of profitability due to inadequate management strategies were also identified.

In conclusion, this research highlights the importance of a strategy that contributes to a successful integration of social media in companies. SMEs must carefully assess the potential benefits against the risks and have the resources, skills and management commitment to effectively address the complexities of digital marketing. Future research should delve deeper into comparative, longitudinal and qualitative studies for a more complete understanding of the phenomenon.

Declarations

Conflict of interest

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

Authors' contribution

Leal-Durán, Jhesica Faxuri: Conceptualisation, methodology, formal analysis and writing.

Cadena-López, Aydé. Validation, formal analysis and revision.

Rivera-González, Gibrán: Validation, revision and editing.

Availability of data and materials

Academic databases were used for the literature review, such as EBSCO, Science Direct, Web of Science, Scopus, Scielo, Google Scholar and Redalyc. The sum of articles found was extensive and available in both English and Spanish.

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Abbreviations

PYMES	Small and medium-sized enterprises
SMES	Small and Medium-sized Enterprise

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Background

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Article

Strawberry (*Fragaria L.*) transportation model in Mexico for Closed Market

Modelo de transporte de fresa (*Fragaria L.*) en México para Mercado Cerrado

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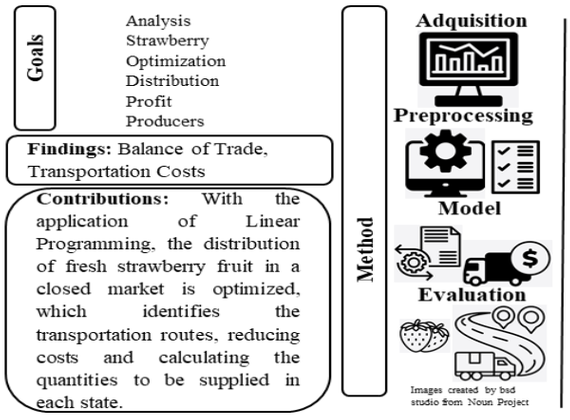
Abstract

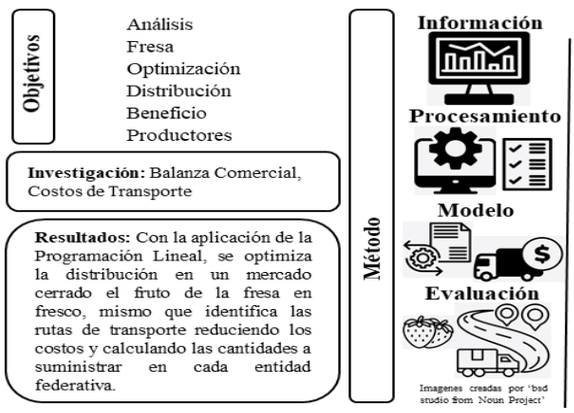
The objective of this research is to develop a transportation model for the optimization of strawberry distribution in Mexico in a closed market through the use of linear programming. The formulation of this model includes the objective function and supply and demand constraints derived from various calculations and research. The information gathered comes from official sources such as SIACON, INEGI and the Foreign Trade Information Cube of the Bank of Mexico. On the other hand, transportation costs are calculated using GlobalMap© and the resolution of the model through LINDO 6.1® software. This model allows for the identification of optimal routes and quantities for distribution between strawberry supplying and demanding states, and not only optimizes internal logistics, but also reduces transportation costs.



Transport model, Strawberry, Closed market

Resumen

El objetivo de esta investigación es desarrollar un modelo de transporte para la optimización de la distribución de las fresas en México en un mercado cerrado a través de la utilización de la programación lineal. La formulación de este modelo incluye la función objetivo y restricciones de oferta y demanda derivadas de diversos cálculos e investigaciones. La información recopilada, proviene de fuentes oficiales como SIACON, INEGI y el Cubo de Información de Comercio Exterior del Banco de México. Por otro lado, los costos de transporte son calculados mediante el uso de GlobalMap© y la resolución del modelo a través del software LINDO 6.1®. Este modelo permite la identificación de rutas y cantidades óptimas de distribución entre estados oferentes y demandantes de fresa, además de ello, no sólo optimiza la logística interna, sino que también permite la reducción de costos asociados al transporte.



Modelo de transporte, Fresa, Mercado cerrado

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Introduction

The efficient distribution of perishable products such as strawberries, given their delicate nature and short shelf life, is a very important issue. Its characteristics generate the need to transport this product with considerations not only on its transport routes, but also on its specific conditions, which generates higher logistics costs. The development of these models makes it possible to identify the optimal routes with which it is possible to reduce these costs, improving their distribution and guaranteeing the coverage of demand throughout the country.

This model allows the consideration of logistical particularities such as the need for refrigerated transport, while taking into account all that this entails, such as variable costs that differ from those that exist for the transport of goods in dry boxes. The aim of this model is to identify an optimal distribution system that satisfies the demand for the product in Mexico, facing the problems related to logistics. The central hypothesis is that the proposal of an optimal and adequate transport model allows for a reduction in costs and an improvement in internal distribution.

This article is divided into different sections, the first of which presents the theoretical framework with some key concepts related to transport and the product in question. Subsequently, the materials and methods are explained, including the sources of information and data used, the results obtained through the model are also presented, and finally, the conclusions of the research are presented.

Methodology

1. Key concepts

In order to introduce the knowledge in this subject, some necessary concepts are:

1.1. Transport and logistics. Transport is, according to the Royal Spanish Academy, the ‘System of means to conduct people and things from one place to another’ (RAE, 2024, para. 2). On the other hand, logistics refers to the ‘planning framework that allows ... to store and transport its goods’ (Thompson, 2023, para. 2).

1.2. Transport models. Perez (2023) states that these are a ‘technique used in operations research and logistics to solve resource allocation and distribution problems in a transportation system’ (p. 2).

1.3. Perishable goods. Perishable goods refer to goods that have ‘a limited shelf life and can deteriorate rapidly if not handled correctly’ (MLTi Logistics, 2024, para. 2) such as meats, fruits, vegetables, etc.

2. Strawberry

2.1. Characteristics. It is a herbaceous plant with more than a thousand varieties and no more than 50 cm in height, native to temperate zones, it is part of the rosaceae family, its consumption prevents acne and premature ageing, as well as having other health benefits. It is composed of abundant leaves that develop from the rhizome, and white flowers with five petals that bloom during the seasons of short days and low temperatures.

Its fruit is sweet, aromatic, red in colour and very sensitive, so it is harvested with the greatest of care.

Given the sensitivity of the fruit, it is necessary to distribute it in refrigerated containers or lorries, guaranteeing its conservation, humidity and temperature.

3. Sources of information

The information gathered for this research comes from various specialised sources.

Data from the Sistema de Información Agroalimentaria de Consulta (SIACON) were used, from which information on the national production of strawberries was extracted. In addition, FAOSTAT was consulted in order to compile the figures related to imports and exports of this product in Mexico, as well as the Foreign Trade Information Cube of the Bank of Mexico to corroborate the data on strawberry exports and to compile the figures related to imports of this product. In the case of identifying the country's population, the information was obtained from the National Institute of Statistics and Geography (INEGI).

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On the other hand, transport costs were calculated through the use of GlobalMap®, in which fixed and variable costs such as fuel, tolls, drivers' salaries, etc. were established in order to establish representative logistic costs for the study.

4. Transport model for a closed market

For the development of this transport model, it was necessary to identify the supplying and demanding states of this fruit, using the information gathered from the different sources mentioned above. This made it possible to establish three supplying states: Michoacán, Guanajuato and Baja California Sur, which would supply the rest of the republic.

For the correct formulation of the model, the objective function was defined, which seeks to identify the best way to establish origins and destinations at the lowest cost, and for which the transport costs of all suppliers to all demanders and the supply and demand restrictions were required, the former being defined by origin and available quantity, and the latter by destination and required quantity, for which the following structure is considered:

Function Objective

$$\sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij} \qquad [1]$$

Subject to:

Demand Constraints

$$\sum_{j=1}^{n} x_{ij} = a_i, \quad i = 1,2,\dots,n \qquad [2]$$

Supply Constraints

$$\sum_{i=1}^{m} x_{ij} \leq b_j, \quad j = 1,2,\dots,m \qquad [3]$$

With $x_{ij} \geq 0$ for all *i* and for all *j*.

In which:

i= state of origin index *(i=1, i=2,... m)*
j= destination state index *(j=1, j=2,... n)*
m = Number of origins
n = Number of destinations
c_{ij} = cost of transport per unit on the route
x_{ij} = Number of units transported from i to *j*
(i,j) = Union of origin i and destination j
a_i = quantity available by origin
b_j = units required at destination

Supply-side constraints will be limited by the number of origins, while demand-side constraints will be limited by the number of total destinations. With the above, it was possible to propose an objective function composed of 87 terms resulting from the 3 supplying states and the 29 demanders, as shown below.

$$MIN \qquad Z_0 = C_{ij}X_{ij} + \cdots + C_{mn}X_{mn} \qquad [4]$$

Whereas:

Z_0 = Value of the objective function
i= Originating state index (bidder), where i=1,2, … , m
j= Target state index (claimant), where j=1,2, … , n
X_{ij}= Decision variable determined with the solution of the model (quantity of strawberries allocated from i to j).
C_{ij}= Coefficient of the variable X_{ij}, represents the amount contributed by each unit of the variable X_{ij}, to the desired total value in the target.

The aim of this model was to distribute the surpluses of the product in question from the supplying states to the demanders in the most efficient and least costly way possible, so by solving it, the origins, destinations and optimal quantities of distribution will be obtained to achieve this objective.

For the execution of the results, the linear programming language LINDO 6.1® will be used, to submit the objective function with the restrictions and thus to know the results in the distribution of strawberries in the closed market in Mexico.

The information represented is based on the year 2022, which is the last one reported in the official libraries with true and reliable information, costs are in Mexican pesos.

Results

For the correct formulation of this transport model, it is necessary to identify the states in which strawberries are produced in Mexico.

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Figure 1 allows a visual identification of the way in which the production of this product is distributed in the country, showing a clear concentration in Michoacán, although there are other areas of interest such as Guanajuato and Baja California, which stand out in comparison with the rest of the states.

Box 1

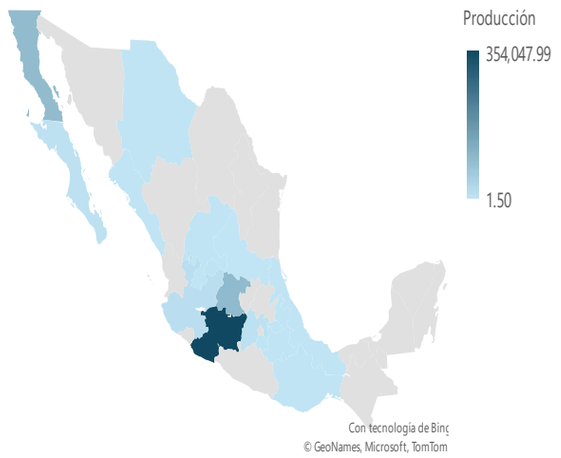

Figure 1

National strawberry production by state (ton)

With the use of the information collected on production, population, exports, imports, industry and consumption by state, it was possible to calculate and identify the supplying and demanding states, as well as the corresponding surplus or deficit, and the per capita consumption, with an average Mexican consuming 2.43 kilograms of the fruit.

Table 1 shows more precisely the category in which each state is classified, allowing to continue with the analysis for the execution of the model.

The result shows that only 3 states are the ones that have after their own consumption, excess production, so they can supply the other states that are demanders of this product or that do not produce it. As shown in Figure 2.

Box 2

Table 1

Strawberry supply and demand by state (ton)

State	Oferta/ Demanda
Bidders	
Baja California Sur	2,680.67
Guanajuato	41,745.06
Michoacán	198,505.63
Applicants	
Aguascalientes	1,793.55
Baja California	8,370.99
Campeche	2,288.11
Chiapas	7,891.35
Chihuahua	1,743.81
Ciudad de México	14,125.08
Coahuila de Zaragoza	9,399.15
Colima	18,463.93
Durango	4,553.62
Guerrero	8,729.65
Hidalgo	7,695.89
Jalisco	8,877.72
México	29,564.78
Morelos	4,764.81
Nayarit	3,083.87
Nuevo León	12,066.51
Oaxaca	9,998.88
Puebla	13,310.45
Querétaro	6,025.81
Quintana Roo	4,745.84
San Luis Potosí	7,018.88
Sinaloa	7,435.32
Sonora	7,366.85
Tabasco	5,928.83
Tamaulipas	8,823.42
Tlaxcala	3,009.49
Veracruz	16,183.23
Yucatán	5,834.09
Zacatecas	3,837.46

Source: Own elaboration

Box 3

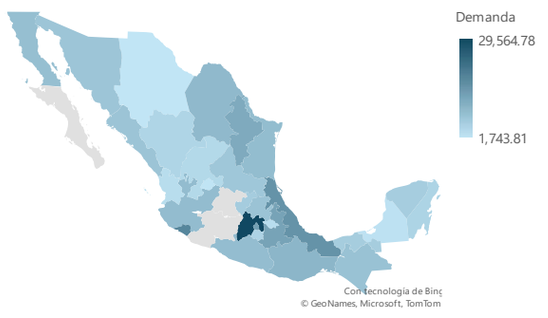

Figure 2

Cutter demand states (ton)

Source: Own elaboration

With this information on suppliers and demanders, a search is carried out for the transport costs that correspond to each of the suppliers to each of the demanders, which will be used within the objective function, mathematically called C_{ij}.

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Due to the characteristics of the product in question, i.e. strawberries, it is necessary to take into account that the necessary transport for this fruit must be refrigerated, allowing it to be kept in optimum conditions and avoiding its deterioration during transport. The costs calculated were based on a 3-axle lorry with a refrigerated 20 ft. container. Table 2 shows the transport cost calculations using GlobalMap® Mexico.

Box 4

Table 2

Transport costs from suppliers to buyers (MXN)

State …	Offerent		
Applicant	**Michoacán**	**Guanajuato**	**Baja Calif. Sur**
Aguascalientes	7,351.42	4,403.11	43,440.89
Baja California	46,789.49	46,474.56	15,642.05
Campeche	27,738.43	29,522.89	71,484.62
Chiapas	22,710.79	23,342.68	65,304.39
Chihuahua	25,118.62	22,117.41	35,739.31
Cd de México	7,260.00	7,403.47	49,853.60
Coahuila	15,011.53	10,998.51	43,567.10
Colima	10,102.53	9,787.51	41,295.80
Durango	15,157.25	11,003.58	32,734.53
Guerrero	11,154.13	12,171.59	54,900.42
Hidalgo	7,029.19	7,661.08	49,622.77
Jalisco	5,501.39	6,311.47	38,371.29
México	6,673.66	8,110.65	48,062.72
Morelos	7,378.06	8,990.23	50,989.40
Nayarit	11,230.31	10,915.27	33,099.31
Nuevo León	16,294.48	12,231.90	45,239.52
Oaxaca	15,102.21	16,890.30	58,842.48
Puebla	9,264.43	9,886.52	53,000.81
Querétaro	4,923.96	3,729.17	45,211.78
Quintana Roo	31,253.00	31,884.91	73,837.11
San Luis Potosí	8,790.36	4,429.09	41,181.03
Sinaloa	22,029.28	21,714.35	23,930.77
Sonora	34,570.77	34,255.73	28,442.87
Tabasco	21,235.44	22,348.60	64,310.35
Tamaulipas	13,589.08	9,536.18	51,450.74
Tlaxcala	9,162.85	9,710.03	52,824.31
Veracruz	11,624.52	12,256.51	55,370.80
Yucatán	31,493.33	32,216.00	74,168.23
Zacatecas	9,499.81	6,583.46	38,317.19

Source: Own elaboration

Taking into account the set of data collected throughout the research and making use of these data for the execution of the distribution model proposed through the linear programming package LINDO 6.1®, the result is a value in the objective function of $32,807'520,000.00 as the transport cost for the total distribution of the production offered to all the deficit states.

According to the results obtained by executing the programme, Michoacán is the main state supplying most of the strawberry demanders, Guanajuato follows, supplying states such as Durango, Nuevo León, San Luis Potosí and Tamaulipas while complementing the demand of Coahuila together with Michoacán. Finally, Baja California Sur is only in charge of distributing its product to Baja California Norte, covering the remaining demand after Michoacán (Table 3). For the cells where no information is available, it means that the supplier does not send anything to the demander in that state, since that route is not optimal to be supplied.

On the other hand, to cover the demand completely, of the 313,926.29 tonnes of available strawberry offered in the whole country according to the results, it is convenient to transport only 242,931.36 tonnes, covering 77.38% of the demand of all those states lacking or null in production of this fruit.

Box 5

Table 3

Results of the model for optimal strawberry distribution in Mexico (ton)

State …	Oferent		
Applicant	**Michoacán**	**Guanajuato**	**Baja Calif. Sur**
Aguascalientes	1,793.55		
Baja California	5,690.32		2,680.67
Campeche	2,288.11		
Chiapas	7,891.35		
Chihuahua	1,743.81		
CDMX	14,125.08		
Coahuila	116.52	9,282.63	
Colima	18,463.93		
Durango		4,553.62	
Guerrero	8,729.65		
Hidalgo	7,695.89		
Jalisco	8,877.72		
México	29,564.78		
Morelos	4,764.81		
Nayarit	3,083.87		
Nuevo León		12,066.51	
Oaxaca	9,998.88		
Puebla	13,310.45		
Querétaro	6,025.81		
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San Luis Potosí		7,018.88	
Sinaloa	7,435.32		
Sonora	7,366.85		
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Zacatecas	3,837.45		

Source: Own elaboration

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Conclusions

Transport models are a key element in the distribution of goods, especially when it comes to perishable products, as they allow for logistical optimisation and contribute to competitiveness.

As can be seen in the results of the model proposed for the year 2022, throughout this research, it covers 77.38% of the national demand for strawberries, with states such as Michoacán, Guanajuato and Baja California Sur as its main suppliers due to the surplus they have; among them we can identify Michoacán as the most outstanding given its production capacity, positioning itself as the number one at the national level and being the main supplier as a consequence of this.

Similarly, and although it is not included among the suppliers, it is important to mention Baja California Norte, given that this state is the only one that positioned itself in that year as a producer of strawberries for export in all of Mexico, according to the information shared in the SIACON 2022.

Although the model does not manage to cover the entire demand, it can serve as a reference for the design of a more efficient distribution system not only for strawberries, but also for the distribution of other perishable products with similar requirements, such as the use of refrigerated boxes.

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.

Authors' Contribution

Quintero-Ramírez, Juan Manuel: Contributed to the project idea, research method and technique. He supported the design of the field instrument. Worked on the application of the field instrument, data collection and systematisation of the results. He carried out the data analysis and systematisation of results, as well as writing the article.

Omaña-Silvestre, José Miguel: Contributed to the research design, the type of research, the approach, the method and the writing of the article.

García-Rico, Perla Araceli: Carried out the systematisation of the background for the state of the art. She supported the design of the field instrument. She also contributed to the writing of the article.

Availability of data and materials

The images of the maps were obtained with Bing Technology, Microsoft GeoNames©, TomTom. The images of the Graphic Summary were obtained from the web page https://thenounproject.com/.

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The research did not receive any funding.

Abbreviations

SIACON	Agri-Food Information System for Consultation
MLTi	Logistics Consultant
RAE	Real Academia Española
FAOSTAT	Food and Agriculture Organization
INEGI	Instituto Nacional de Estadística y Geografía (National Institute of Statistics and Geography)
Ton	Tons

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Article

Digital profile of the entrepreneur: A case study of IGE-ITNL

Perfil digital del emprendedor: caso de estudio IGE-ITNL

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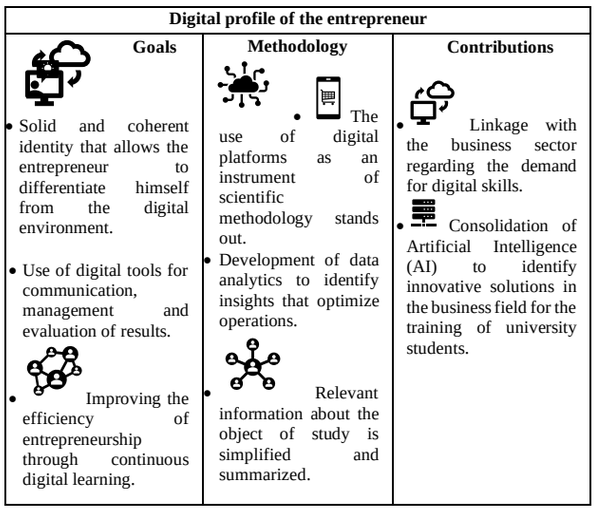
Resumen

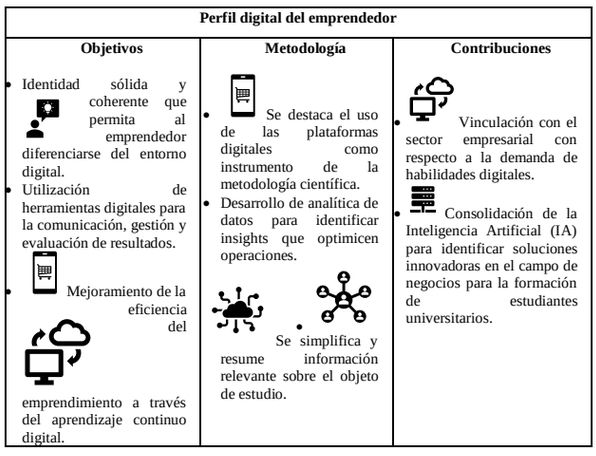
This study aims to analyze the digital profile of the entrepreneur of the students of the Business Management Engineering degree at the Technological Institute of Nuevo León. A descriptive study was carried out, with the purpose of analyzing the digital skills that make up said profile. The main contribution of the study lies in how the tools that make up emerging technologies represent a competitive advantage for an entrepreneur to face the challenges of digital businesses, based on the fact that an interaction with the audience through digital platforms favors digital visibility. of a brand or business, which facilitates the connection with potential clients, strategic partners and investors in efficient business growth. Finally, the results of this study will help design educational strategies that close these differences, preparing future professionals to successfully face the challenges of a business world dominated by technology.



Emerging technologies, Innovation, Entrepreneur

Resumen

Este estudio tiene como objetivo analizar el perfil digital del emprendedor de los estudiantes de la carrera de Ingeniería en Gestión Empresarial del Instituto Tecnológico de Nuevo León. Se realizó un estudio descriptivo, con el propósito de analizar las competencias digitales que conforman dicho perfil. La contribución principal del estudio radica en como las herramientas que conforman las tecnologías emergentes representan una ventaja competitiva para que un emprendedor pueda enfrentar los desafíos de los negocios digitales partiendo de que una interacción con la audiencia a través de las plataformas digitales favorece a la visibilidad digital de una marca o negocio, lo que facilita la conexión con clientes potenciales, socios estratégicos e inversionistas en un eficiente crecimiento empresarial. Finalmente, los resultados de este estudio ayudarán a diseñar estrategias educativas que cierren esas diferencias, preparando a los futuros profesionales para enfrentar con éxito los retos de un mundo empresarial dominado por la tecnología.



Tecnologías emergentes, Innovación, Emprendedor

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Introduction

Digitalisation has transformed the business world, creating an urgent need for entrepreneurs to possess specific skills that respond to this changing environment. As the World Economic Forum (2021) points out, 'the digital economy has given rise to new opportunities, but also to specific demands on the skills and competencies of entrepreneurs' (WEF, 2021). This shift highlights the importance of understanding the profile of the digital entrepreneur in order to align educational skills with the demands of today's market, ensuring that future professionals are better prepared to face digital challenges.

Understanding the skills that make up the profile of the digital entrepreneur is therefore crucial to increase competitiveness in an increasingly globalised market. According to the European Commission (2021), 'advancing digital skills not only boosts innovation, but also strengthens the local and regional business fabric' (European Commission, 2021).

This allows entrepreneurs not only to adapt to technological transformations, but also to seize emerging opportunities at the global level, thus enhancing their ability to innovate. Indeed, digital entrepreneurship has gone from being a strategic option to becoming a necessity for companies to survive in an increasingly demanding environment. Nambisan (2017) highlights that 'digital technologies have redefined the scope and boundaries of entrepreneurship' (Nambisan, 2017), transforming the entrepreneurial ecosystem into a space where rapid adaptation is key to avoid lagging behind.

In this way, being able to assess digital skills in students is therefore a fundamental step in bridging the gap between current skills and the needs of the labour market. 'Emerging economies need to develop advanced digital skills to remain competitive in a global market', says a study by Da Nang University (Truong & Le Dinh, 2023).

This is especially relevant in areas where economic development depends on digital innovation. In this regard, digital skills including advanced use of online platforms and adaptability to new technologies have become essential for entrepreneurs.

A study by Bensaid and Azdimousa (2021) emphasises that 'digital entrepreneurship is inherently different from traditional entrepreneurship because of the technological variables that determine entrepreneurial success' (Bensaid & Azdimousa, 2021). This underlines the need for training that is more adapted to today's technological demands.

In educational institutions such as ITNL, the creation of a digital entrepreneur profile allows for a more precise orientation of training programmes towards the needs of today's market. According to Santos and Torkomian (2021), 'matching skills and knowledge to the demands of the digital environment is key to the success of entrepreneurs' (Santos & Torkomian, 2021).

This approach ensures that students receive preparation aligned with the competences they will actually use.

Adapting to this digital ecosystem also implies an evolution in educational methodologies, which now focus on the development of essential digital competences. Fernandes et al. (2022) highlight that 'digital platforms have revolutionised the way entrepreneurs connect and create value', facilitating the emergence of innovative business models that drive the economy (Fernandes et al., 2022).

For GSE students, mastering digital tools is key to building competitive profiles in a technology-dominated labour market. García Flores and Ángeles Castro (2023) state that 'the profile of the innovative entrepreneur is essential to promote effective policies in developing countries' (García Flores & Angeles Castro, 2023). This demonstrates how digital readiness has a direct impact on the employability and competitiveness of these future entrepreneurs.

Characterising these student profiles also makes it possible to design educational policies that respond effectively to the needs of the digital market.

The European Commission (2021) stresses the urgency of 'promoting skills that enable entrepreneurs to adapt to constant technological innovations' (European Commission, 2021), which reinforces the importance of assessing and defining digital competences in academic education.

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Thus, in the context of higher education, analysing the profile of digital entrepreneurs contributes to identifying and closing critical skills gaps for the digital economy. 'Investment in digital skills has a direct impact on entrepreneurship and innovation capacity', stresses the World Economic Forum (2021), underlining the relevance of education adapted to today's challenges.

Establishing a digital profile of entrepreneurs in training also helps to anticipate and mitigate the risks of failure in a constantly evolving digital market. Nambisan and Baron (2017) note that 'technological interdependence demands that entrepreneurs develop versatile skills to adjust to market changes', making evident the need to prepare students for a fast-changing environment.

Having skills in digital platforms gives students an important advantage over those who are not digitally literate. According to the European Commission (2021), 'lack of digital skills can be a barrier to entrepreneurship and innovation in emerging economies', which accentuates the urgency of establishing an educational profile aligned with the demands of the digital environment.

Therefore, analysing digital competences facilitates the creation of educational ecosystems that promote the development of skills aligned with technological advances. Fernandes et al. (2022) point out that 'a digital entrepreneurial ecosystem provides an optimal environment for innovation and creativity', thus offering an ideal framework for future entrepreneurs.

Therefore, identifying and developing digital skills in students not only fosters individual success, but also contributes to collective economic well-being. 'Digital skills are a fundamental pillar for economic growth and digital transformation', concludes the World Economic Forum (2021), highlighting the positive impact that these skills can have on the economy and society at large.

Advantages of the Digital Entrepreneur Profile

The assessment of digital competencies in digital entrepreneurs focuses on specific skills that are not addressed in depth in traditional entrepreneurship models.

According to the World Economic Forum (2021), 'digital competencies enable entrepreneurs to adapt quickly to technological change, a critical skill in today's business context' (World Economic Forum, 2021). This approach highlights skills such as technological adaptability and innovation, which are crucial for success in a digital business environment.

Unlike traditional skills assessments, the study of digital skills in entrepreneurs allows for a dynamic and technology-specific analysis. The European Commission (2021) states that 'the development of digital skills is essential to ensure that young entrepreneurs can compete and excel in the digital economy' (European Commission, 2021). Thus, this assessment adds value by providing a specific framework to address the challenges of digital entrepreneurship and improve the competitiveness of future entrepreneurs.

The digital skills analysis focuses not only on technical skills, but also on the development of the following:

1. *Online business management* is a fundamental skill for digital entrepreneurs, as digital transformation has created new ways of operating and managing businesses. According to the World Economic Forum (2021), 'the ability to manage businesses in digital environments enables entrepreneurs to adapt to an increasingly globalised and competitive market' (WEF, 2021). This skill is key to managing operations, optimising processes and making strategic decisions in real time, essential elements for achieving a competitive advantage in the digital environment.

2. *Digital finance and accounting* represent another indispensable competence, as they allow entrepreneurs to optimise their resources and ensure the economic sustainability of their projects. The European Commission (2021) emphasises that 'knowledge of digital finance is crucial for entrepreneurs to manage cash flows, control expenses and maximise the use of resources on digital platforms' (European Commission, 2021).

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This skill also helps entrepreneurs to make informed financial decisions and maintain economic stability in a context of volatility.

3. In the digital sphere, *graphic design and content creation* are vital for building a visual identity and conveying effective messages to users. As Santos and Torkomian (2021) point out, 'the ability to design and generate attractive visual content allows entrepreneurs to capture the attention of their audience and stand out in a saturated digital market' (Santos & Torkomian, 2021). This skill, beyond its visual aspect, is a strategic tool for communicating brand values and establishing solid relationships with customers.
4. *Digital promotion and advertising* are essential competencies in a world where online presence defines the success of many companies. According to Fernandes et al. (2022), 'the ability to promote and advertise products in digital media allows entrepreneurs to maximise their reach and strengthen their brand in the global marketplace' (Fernandes et al., 2022). With the right digital advertising strategy, entrepreneurs can target specific audiences and optimise their resources to improve marketing ROI.
5. *Data analytics* is another core competency, as it allows entrepreneurs to make data-driven decisions and understand customer behaviour. Truong and Le Dinh (2023) note that 'data analytics is essential for digital entrepreneurs to understand market trends and optimise their strategies' (Truong & Le Dinh, 2023). This skill facilitates the identification of consumption patterns, enables personalisation of offers and improves informed decision making to maximise the impact of commercial actions.
6. *Communication platforms* are critical tools for digital entrepreneurs to manage customer interaction and build strong relationships in virtual environments. The World Economic Forum (2021) stresses that 'the ability to use digital communication platforms is key for entrepreneurs to stay connected with their customers and teams' (WEF, 2021).

This is essential to maintain customer loyalty, manage online reputation and communicate effectively in an interconnected marketplace.

7. *Cybersecurity* is also an indispensable skill in the profile of the digital entrepreneur, given the increase of threats in the online environment.

The European Commission (2021) mentions that 'security in data handling is crucial to protect customer information and maintain trust in digital transactions' (European Commission, 2021). A cybersecurity-savvy entrepreneur protects his or her business from cyber-attacks and ensures data privacy, which is essential in an environment of increasing digitalisation. Together, these skills constitute a comprehensive profile of competencies necessary for digital entrepreneurs to thrive in a dynamic and digitised marketplace. These competencies not only enable them to operate effectively in the digital environment, but also give entrepreneurs the ability to adapt and excel in a constantly evolving marketplace. As stated by the World Economic Forum (2021), 'the development of a digital entrepreneurial profile, with specific skills, enables greater competitiveness and resilience in a digital marketplace' (WEF, 2021).

Assessing the Digital Entrepreneur Profile

Assessing digital competences allows identifying not only knowledge, but also students' capacity for innovation, as it fosters students' creativity and ability to generate disruptive ideas. As mentioned by Bensaid and Azdimousa (2021), 'the digital environment demands innovative skills that enable entrepreneurs to respond quickly to market opportunities and changes' (Bensaid & Azdimousa, 2021). This perspective is essential for modern entrepreneurship and differs from other approaches that focus solely on traditional business skills.

The assessment of digital competences enables the development of autonomous learning skills in students, which is essential in the ever-changing digital environment. As Truong and Le Dinh (2023) state, 'digital entrepreneurs must be self-learners and adapt quickly to new technologies' (Truong & Le Dinh, 2023).

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This added value allows students to develop a growth mindset that is critical in the modern business environment.

Unlike traditional study techniques, the analysis of digital competencies allows for greater integration of technological problem-solving skills. 'The ability to solve technical problems efficiently is critical in digital entrepreneurship' (Nambisan & Baron, 2017), giving students a significant advantage in markets that rely on constant innovation.

Problem Statement and Central Research Question

The central problem of this research lies in the lack of a defined profile of the specific digital competencies that Business Management Engineering (BME) students at ITNL need to develop to perform successfully as digital entrepreneurs. As the World Economic Forum (2021) points out, 'the demand for digital skills in the labour market is increasing, but educational institutions are struggling to meet this need' (World Economic Forum, 2021).

The absence of a clear and specific digital skills profile for GSE students limits their ability to adapt to the digital business environment. 'Technological changes require constant adaptation, and those who are not digitally prepared will quickly fall behind' (Bensaid & Azdimousa, 2021), which highlights the need for this research.

This study addresses the issue of the disconnect between education and the demands of the digital labour market, a recurring theme in emerging economies. The World Economic Forum warns that 'there is a significant gap between the skills demanded by the market and those taught in educational institutions' (World Economic Forum, 2021), which makes the assessment of digital competences in this context urgent.

In the current context, where digitalisation is driving new business models and transforming global markets, it is crucial to understand the competences that shape the profile of a digital entrepreneur. Business Management Engineering (BME) students at the Instituto Tecnológico de Nuevo León (ITNL) are at a formative stage that can define their ability to adapt and excel in the digital environment. Identifying what digital skills these students possess not only allows us to assess their readiness to face the challenges of the digital economy, but also to adapt and strengthen academic actions according to their needs and projections. Therefore, the central question arises: ***What digital skills do GSE students at ITNL currently possess that contribute to their development as digital entrepreneurs?***

This study attempts to define a digital skills profile that prepares GSE students for the specific demands of digital entrepreneurship. 'Creating a skills profile adapted to digital changes allows future entrepreneurs to be better equipped to face market challenges' (Fernandes et al., 2022).

The central research question also suggests that a well-defined digital profile could facilitate the creation of more effective teaching strategies at ITNL that focus on digital skills. According to DigComp 2.0, 'the teaching of digital skills must be tailored to the specific needs of learners and the working environment in which they will be placed' (European Commission, 2016). The lack of specific digital skills in students creates a significant disadvantage compared to other entrepreneurs with training in these areas. 'Digital entrepreneurs have a competitive advantage based on their mastery of digital technologies and tools' (Santos & Torkomian, 2021), which justifies the importance of this research.

Next, the **methodology** section describes the approach and techniques used to identify and assess the digital skills of Business Management Engineering (BME) students at ITNL. Through a structured questionnaire, specifically designed to measure competencies in key areas of digital entrepreneurship, information was collected on the mastery and application of skills such as online business management, digital accounting, content design, and cybersecurity.

In the **results** section, the findings obtained from the data analysis are presented, showing the level of preparedness and areas of opportunity in the digital competences of the students.

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Finally, in the **conclusions** section, the contributions of the research are synthesised, highlighting the competences that students already possess and the areas in which they require strengthening. These conclusions point to possible improvements in the academic curriculum, with the aim of strengthening the digital entrepreneurial profile and ensuring training that is aligned with the demands of the current market.

Methodology

This research was designed as a descriptive study, with the aim of analysing the digital competences that make up the digital entrepreneur profile of students on the Business Management Engineering (IGE) course at the Instituto Tecnológico de Nuevo León (ITNL).

According to Hernández and Baptista (2014), 'descriptive studies seek to specify the properties, characteristics and profiles of people, groups, communities or any other phenomenon that is subjected to analysis' (p. 92). As this is a descriptive research approach, the main objective was to identify and describe the current digital skills of students and how these relate to the development of an entrepreneurial profile in the digital environment.

To select the participants for this study, a non-probabilistic sample was used, as ITNL GSE students represented a specific group with particular characteristics for the analysis. Purposive sampling was used, choosing those students who were in their final semesters of the degree and who, consequently, have had exposure to both digital content and business management training, with 196 students being evaluated. According to Sampieri et al. (2014), purposive sampling 'allows for the selection of subjects who have particular characteristics relevant to the objective of the study' (p. 174).

This approach made it possible to focus the analysis on those who, due to their progress in the academic programme, have a preparation close to the graduate profile.

The main research tool used was a structured questionnaire, specifically designed to measure digital competences in key areas of digital entrepreneurship.

The questionnaire included 10 questions in total on skills in online business management, digital accounting and finance, graphic design and content creation, digital promotion and advertising, data analytics, use of communication platforms, and cybersecurity. Each section of the questionnaire was designed to obtain detailed information and allow for a comprehensive assessment of the competences relevant to the digital entrepreneur profile. As mentioned by Díaz-Bravo et al. (2013), 'the structured questionnaire allows for the collection of accurate and homogeneous data on specific competences' (p. 47).

The questionnaire was administered to students face-to-face on the ITNL campus and, in some cases, via a digital platform to facilitate access and participation. The questions were structured in a Likert scale format, which allowed students to assess their level of mastery in each specific competence, with options ranging from 'Not at all, A little, Somewhat, Somewhat, Quite a lot, A lot'. According to Bisquerra (2012), 'the Likert scale is useful for capturing the perception of the level of competence possessed by the evaluee' (p. 82). This format was chosen to capture the self-assessment of the students' level of competence in each digital area.

To ensure the validity of the research tool, the questionnaire underwent a review by experts in digital competences and assessment methodologies in higher education. The review made it possible to adjust certain items and ensure that the questions were clear and relevant to the context of GSE students at ITNL. As Hernández Sampieri (2014) points out, 'validation by experts is a crucial step to ensure that research instruments are clear, relevant and meet the stated objectives' (p. 145). A pilot test was also conducted with a small group of students, whose feedback helped to refine the questions and adjust the length of the questionnaire to ensure the quality of the data obtained.

Once the questionnaire was administered, the collected data were organised and structured in a digital database. Data analysis was carried out using descriptive statistics, which allowed for the identification of patterns and trends in the responses.

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Frequencies, means and standard deviations were calculated for each digital competence, which provided a detailed understanding of the levels of mastery and the areas in which students showed higher or lower skills. Descriptive statistics, as Sampieri (2014) indicates, 'allows us to summarise, simplify and organise information in order to obtain relevant conclusions about the object of study'.

To deepen the analysis, the data were also segmented according to demographic variables such as semester and age. This segmentation made it possible to observe whether there were significant differences in students' digital skills according to their degree of progress in their studies and other individual characteristics. According to Maruyama and Ryan (2014), 'segmenting data by demographic characteristics allows for the identification of patterns and differences in specific subgroups' (p. 132). This comparison provided additional information on how digital skills evolve as students progress through their academic education.

Finally, the results obtained from the descriptive analysis were interpreted and contextualised in relation to the research objectives, making it possible to identify the digital competences that students already possess and those in which further training is needed. These findings served as a basis for proposing improvements to the GSE curriculum in order to strengthen academic actions that contribute to efficient performance in the workplace and entrepreneurship. As González, Zerpa, Gutiérrez and Pirela (2007) conclude, 'the results of educational research can guide curricular changes and strengthen areas of opportunity in vocational training'.

Results

The following are the results obtained from the survey applied to Business Management Engineering (BME) students at the Instituto Tecnológico de Nuevo León (ITNL), which aimed to identify the digital skills of students that are relevant to the profile of a digital entrepreneur. The data collected provides a detailed overview of students' current skills in areas such as online business management, digital accounting, content design, digital advertising, data analytics, and cybersecurity.

These results allow not only to describe the level of competence of students in each area, but also to identify areas of opportunity that can be strengthened from the academy, thus contributing to a more solid training aligned with the demands of the digital market.

The data obtained in question 1: Do you have previous experience in creating or managing online businesses, reflect the levels of experience of students in this area. One third of respondents (33%) indicated no experience in this area ('None'), while 31% report 'Little' knowledge, representing almost another third of the total. Those with a 'Some' level of experience account for 32%, indicating that a significant proportion have some familiarity, though not advanced proficiency. Only a small percentage, 4%, claim to have 'Quite a lot' of experience, and no students report 'A lot' of knowledge in this area.

These results suggest that the majority of GSE students at ITNL have limited experience in creating or managing online businesses. This represents an opportunity to strengthen these competencies in the academic curriculum so that they can develop practical skills that will enable them to be better prepared for entrepreneurship in the digital environment.

Question 2, Do you consider yourself a person able to identify business opportunities in the digital environment and know how to take advantage of them, shows the students' self-perception of their ability to detect and take advantage of opportunities in the digital environment. The majority, 53%, consider themselves to be moderately capable, answering with 'Somewhat'. Some 24% indicated 'Somewhat' proficient in this skill, while 15% felt 'Fairly' able to identify and exploit these opportunities. Only a small percentage, 3%, have a high proficiency ('A lot'), while 5% of students feel that they do not possess this skill at all ('Not at all').

This suggests that, although many students feel moderately skilled, there is an opportunity to strengthen their confidence and skills in identifying and seizing business opportunities in the digital domain. Regarding question 3: Are you familiar with concepts such as digital marketing, e-commerce, data analytics, web development, graphic design, cybersecurity, etc., the graph reflects students' level of familiarity with these key concepts.

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39% have an intermediate knowledge (‘Somewhat’), 29% have ‘Some’ knowledge, and 20% consider themselves ‘Fairly’ familiar.

Only 5% report a high level of knowledge (‘A lot’), while 7% have no knowledge (‘None’).

These results indicate that most students have a basic or intermediate level of familiarity with the digital concepts essential for online entrepreneurship. However, the low percentage of students with advanced knowledge suggests a significant opportunity for further training in these areas.

Question 4, Do you know or have you used any of the following platforms to manage an online shop, process payments and track sales, shows students' familiarity with e-commerce platforms such as Shopify, WooCommerce and Magento. The majority (80%) selected the option ‘None’, indicating that they have no experience with these tools. Only 12% have experience with Shopify, 4% with WooCommerce, and 2% with Magento or all of the above platforms.

This reflects that the vast majority of students have no previous experience with e-commerce platforms, which could limit their ability to manage online businesses effectively. This result suggests an opportunity to include specific training in the use of these tools, given that knowledge of e-commerce platforms is increasingly relevant for entrepreneurs in the digital environment.

For question 5: What tools do you know or have you used to manage the accounting and finances of a digital business, the results indicate a low level of familiarity with digital accounting software. 86% of students selected the option ‘None’, indicating a lack of experience in this area. Only 6% are familiar with Quickbooks, while 3% are familiar with FreshBooks and another 3% with Xero. Only 2% said they had used all the platforms mentioned.

These data indicate that students have little or no experience in using digital accounting tools, which could limit their ability to effectively manage the finances of an online business.

The lack of knowledge in these platforms represents an important opportunity to improve digital accounting training within the academic programme, considering the increasing relevance of these skills in today's business context.

In question 6, Do you know or have you used any of the following graphic design tools to create visual content for social networks, websites or other digital channels, the data shows that 50% of the students are familiar with Canva, being this the most used tool. However, 41% indicated that they have no experience with any of these tools, and a small percentage are familiar with Powtoon (3%) or Kahoot (1%). Only 5% have used all the platforms mentioned.

This indicates that, although Canva is popular among students, there is a lack of knowledge in other visual content creation tools, which represents an opportunity to broaden training in design and digital content, key skills for digital marketing and entrepreneurship.

Question 7, Do you know or have you used any of the following digital tools to promote or advertise an online business, reveals that 49% of students have experience with Facebook Ads, the most popular advertising tool among them. However, 29% selected ‘None’, indicating that they lack experience with digital marketing platforms. Only 11% are familiar with Google Ads and another 11% with Mailchimp, while 1% have used all the tools mentioned and no one reported experience with Buffer or Hootsuite.

These results show that, although Facebook Ads is relatively popular, there is a low level of familiarity with other social media management and advertising tools, suggesting a need for training on digital marketing platforms. Finally, question 8: In terms of data analytics, are you familiar with or have you used any of the following tools to track, measure and analyse the performance of digital campaigns and strategies, reveals that 44% of the students have no experience with any digital analytics tools. 24% report familiarity with Google Analytics, 18% with Facebook Analytics, and 10% with HubSpot. Only 4% have used all of the above tools.

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These results suggest that, although some students have experience with specific tools such as Google Analytics and Facebook Analytics, a large majority lack knowledge in digital analytics, which shows the importance of strengthening this competence in the academic environment for better performance in digital entrepreneurship.

Regarding **question 10:** *Do you know or have you used any of the following IT security tools*, students' level of familiarity with cybersecurity tools such as antivirus software (e.g. Avast, McAfee, Norton and Bitdefender), firewalls (such as Windows Defender, ZoneAlarm and Comodo Firewall), and cloud security services (such as Microsoft Azure, Amazon Web Services and Google Cloud Platform) was analysed, in addition to the option of having used all the tools mentioned. The results indicate that 30% of the students are familiar with antivirus software, with antivirus being the most popular cybersecurity tool among the students. Some 22% indicated that they have no experience with any of the cyber security tools ('None'). Another 20% have knowledge of cloud security services, while 18% are familiar with firewalls. Only 10% of the students claimed to have used all the tools mentioned.

These results suggest that, although a proportion of students have basic knowledge of cybersecurity, especially in the use of antivirus, there is a significant gap in knowledge of advanced tools, such as cloud security services and firewalls. This represents an opportunity to improve cybersecurity training, an essential skill for any digital entrepreneur who needs to protect both their business information and that of their customers.

Conclusions

Digital transformation is redefining the profile of the modern entrepreneur, highlighting skills such as online business management and data analytics. The World Economic Forum (2021) emphasises that 'digital skills enable entrepreneurs to adapt quickly to technological change, a critical skill in today's business context' (WEF, 2021). However, the results show that the majority of GSE students at ITNL have no previous experience in creating or managing online businesses, which represents an opportunity to strengthen this competence from the academic environment.

Regarding the identification and exploitation of business opportunities in the digital environment, the data reflect a moderate self-perception among students. According to the European Commission (2021), the development of digital skills is crucial to ensure that young entrepreneurs can compete in the digital economy (European Commission, 2021). The lack of confidence in this skill suggests that students need more training and practice to improve their ability to identify and seize opportunities in the digital domain.

Familiarity with essential concepts such as digital marketing, e-commerce and cybersecurity is limited among GSE students. Low expertise in these areas is a sign that the curriculum could benefit from greater integration of digital skills. As Santos and Torkomian (2021) point out, 'digital entrepreneurs must possess specific skills in digital platforms that allow them to maximise their market impact' (Santos & Torkomian, 2021).

Lack of experience in using e-commerce platforms is another important finding. Only a small proportion of students have used tools such as Shopify or WooCommerce, which limits their ability to manage online businesses. According to Bensaid and Azdimousa (2021), the digital environment requires innovative skills that enable entrepreneurs to respond to market changes (Bensaid & Azdimousa, 2021).

In the field of digital accounting and finance, most students lack experience with tools such as Quickbooks or Xero. This is worrying, as digital finance skills are key to the economic sustainability of entrepreneurial projects. The European Commission (2021) notes that 'knowledge in digital finance is crucial for entrepreneurs to manage cash flows and maximise the use of resources on digital platforms' (European Commission, 2021).

The popularity of Canva among students is positive, but the lack of knowledge in other graphic design tools suggests incomplete training in visual content creation. As the World Economic Forum (2021) mentions, 'the ability to design and generate engaging visual content enables entrepreneurs to capture the attention of their audience' (WEF, 2021). This skill is fundamental in digital marketing and visual communication to strengthen a brand's identity.

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Limited familiarity with digital advertising tools, such as Google Ads and Mailchimp, reveals a lack of preparation in the field of digital promotion. According to Fernandes et al. (2022), 'the ability to promote products in digital media enables entrepreneurs to maximise their global market reach' (Fernandes et al., 2022). This finding suggests that students need stronger training in digital marketing strategies.

Data analytics is a key competency for digital entrepreneurship, as it enables data-driven decision-making. However, most students lack knowledge in digital analytics tools. Truong and Le Dinh (2023) highlight that 'data analytics is essential for digital entrepreneurs to understand market trends' (Truong & Le Dinh, 2023). This finding indicates an opportunity to improve data analytics training.

Lack of experience with video conferencing platforms, such as Microsoft Teams and Google Meet, can limit students' abilities to coordinate teams and communicate in the digital environment. In a context where online communication is vital, the use of these tools is essential. The World Economic Forum (2021) underlines the importance of the ability to use digital communication platforms to maintain effective relationships in an interconnected marketplace (WEF, 2021). Most students have limited knowledge of advanced cybersecurity tools, such as firewalls and cloud services. The European Commission (2021) notes that 'secure data handling is crucial to maintain trust in digital transactions' (European Commission, 2021). This finding shows the need to strengthen cybersecurity training within the academic curriculum.

Declarations

Conflict of interest

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

Authors' Contribution

Delgado-Torres, Claudia Lizethe: Mainly responsible for the design and conceptualisation of the research.

Claudia Lizethe led the literature review, the development of the methodology, and the writing of the introduction and conclusions.

In addition, she coordinated the data collection process and supervised all phases of the research to ensure consistency and compliance with the objectives.

Delgado-Torres, Laura Patricia: In charge of the structuring and application of the data collection tools, such as the questionnaires applied to the students. Laura Patricia also collaborated in the analysis of the data collected and the interpretation of the results.

Ríos-Castillo, Maricela: Responsible for the statistical analysis of the data. Maricela organised the database and applied descriptive statistical techniques to interpret the findings clearly and accurately. She also collaborated in the methodological review and in the elaboration of the figures and tables presented in the study.

Hernández-Saldívar, Elisa: Responsible for the theoretical review and support in the drafting of the theoretical framework. She also assisted in the final editing of the manuscript and in the verification of citations and references.

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Data availability is as presented in this article.

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Abreviaturas

IGE	Business Management Engineering
ITNL	Nuevo León Institute of Technology

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Article

Proposal of learning strategies for the subject of Quality Systems Management for Industrial Engineering, at the Technological Institute of Villahermosa

Propuesta de estrategias de aprendizaje para la asignatura de Gestión de los Sistemas de Calidad para Ingeniería Industrial, en el Instituto Tecnológico de Villahermosa

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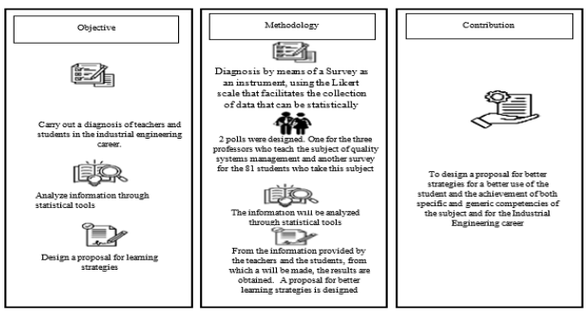
Abstract

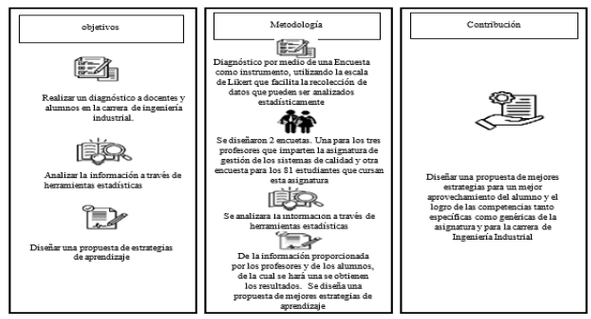
The objective of this project is to propose learning strategies for the subject of management of quality systems for industrial engineering, at the Technological Institute of Villahermosa Tabasco.A diagnosis will be made by means of a Survey as an instrument, using the Likert scale that facilitates the collection of data that can be statistically analyzed. 2 polls were designed. One for the three professors who teach the subject of quality systems management and another survey for the 81 students who take this subject. Subsequently, the information will be analyzed through statistical tools. From the information provided by the professors and the students, from which a result will be made, the results of the information provided by both are obtained, so that a proposal for better learning strategies for the Industrial Engineering career can be designed, thus achieving a better use of the student and the achievement of both specific and generic competencies of the subject and for the Industrial Engineering career.



Competencies, Survey, Learning strategies

Resumen

Como objetivo de èste proyecto, se tiene el proponer estrategias de aprendizaje para la asignatura de gestión de los sistemas de calidad para ingeniería industrial, en el Instituto Tecnològico de Villahermosa Tabasco. Se harà un diagnòstico por medio de una Encuesta como instrumento, utilizando la escala de Likert que facilita la recolección de datos que pueden ser analizados estadísticamente. Se diseñaron 2 encuetas. Una para los tres profesores que imparten la asignatura de gestión de los sistemas de calidad y otra encuesta para los 81 estudiantes que cursan esta asignatura. Posteriormente se analizará la información a través de herramientas estadísticas. De la información proporcionada por los profesores y de los alumnos, de la cual se hará una se obtienen los resultados de la información proporcionada por ambos, para que se pueda diseñar una propuesta de mejores estrategias de aprendizaje para la carrera de Ingeniería Industrial logrando con esto un mejor aprovechamiento del alumno y el logro de las competencias tanto específicas como genéricas de la asignatura y para la carrera de Ingeniería Industrial



Competencias, Encuesta, Estrategias de aprendizaje-

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Introduction

The training of professionals in industrial engineering faces the constant challenge of adapting to the demands of the current working environment, where competence and innovation in quality management are essential.

However, at the Instituto Tecnológico de Villahermosa, the teaching of the subject 'Quality Systems Management' is mostly oriented towards traditional methods of theoretical exposition, which limits the development of critical competences in students.

For Monereo (1994), learning strategies are planned behaviours that select and organise cognitive, affective and motor mechanisms in order to face global or specific learning problem situations; that is, the use of certain strategies depends on the idea that there are activities or processes that do not act at the same cognitive level and that the degree of generality is not the same in all of them; it is the knowledge that the person has about his own learning processes that allows him to plan his strategies in a more effective and flexible way according to the type of information he intends to acquire. It is therefore important that the learner has the necessary knowledge to understand the learning strategies used by the teacher.

Not all learners are able to learn knowledge, skills, beliefs and behaviours to the same extent; part of these differences is due to the dominant learning style that a person possesses, as well as the strategies and their willingness to use them in the learning process. This knowledge allows us to highlight the importance of identifying the learning styles that individuals possess in an educational environment, in order to plan academic activities aimed at promoting a successful teaching-learning process.

This research project arises from the need to transform these pedagogical strategies towards a more active approach focused on meaningful learning, allowing students to practically link theoretical knowledge and develop skills applicable in the industrial context. Through an exhaustive diagnosis, in which the strategies currently employed will be analysed and their effectiveness on student learning will be evaluated, this study aims to design and implement new teaching methodologies.

These methodologies will seek to foster critical thinking, problem solving and teamwork, key elements for training competent professionals capable of facing the challenges of the quality industry.

This project aims not only to improve academic performance and student motivation, but also to contribute to strengthening the educational quality of the Industrial Engineering programme. The relevance of this project lies in the need to renew teaching in this subject, which will have a positive impact on educational quality and institutional competitiveness.

The project considers the Generalities of the project, then the Theoretical Framework, Methodology, Results obtained and the design of a proposal to improve the strategies used by the teacher.

General information about the project:

Background of the Research

In previous years at the Instituto Tecnológico de Villahermosa some teaching projects have been carried out, it has been identified that several teachers use the same teaching strategies for years, which has been detrimental to the adequate achievement of the competences that an industrial engineering student should reach. Based on this background, the present project focuses on the subject of Quality Systems Management.

Problem statement

The traditional methodologies used by lecturers at the institution have proved to be insufficient to develop the necessary competences. This research seeks to answer the question of how to optimise teaching practices in the subject of 'Quality Systems Management' in order to promote comprehensive training that is in line with the demands of the professional environment.

Currently, it has been observed that student learning is deficient, and it is considered that some of the causes are because the teacher does not motivate the student to show interest in the subject he/she is teaching and that the learning strategies used are repetitive and inadequate and do not capture the interest of the students.

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Justification

It is important to carry out this project because it will make it possible to evaluate the teaching strategies used by the teachers and what opinion the students have of the knowledge they acquire with the strategies used by the teacher. In other words, the project focuses on the two scenarios, both the teacher and the students, and a comparison is made between these two scenarios, in order to present proposals for improvement in the learning strategies for the subject of study in industrial engineering. All this will be of great benefit to achieve meaningful learning.

Aim of the research.

To propose learning strategies for the subject of quality systems management for industrial engineering at the Technological Institute of Villahermosa Tabasco. **Specific objectives:** To carry out a diagnosis of teachers and students in the industrial engineering course. To analyse the information through statistical tools and to design a proposal for learning strategies.

Theoretical framework

Learning strategy: According to Winstein and Mayer (1986), learning strategies can be defined as 'behaviours and thoughts that a learner uses during learning with the intention of influencing his or her coding process'. And according to Vivas López, N. A. (2010), learning strategies are activities or sets of activities that facilitate learning and allow the learner to control his or her own learning process. These strategies can be cognitive, such as prediction, inference, analysis and synthesis, or interactive, such as peer cooperation and student-teacher interaction.

For other authors, learning strategies are sequences of procedures or plans oriented towards the achievement of learning goals, while specific procedures within that sequence are called learning tactics. In this case, strategies would be higher level procedures that would include different learning tactics or techniques.

Learning strategies can then be said to be activities or sets of activities that facilitate learning and the learner's self-management of learning.

They are considered as general plans to achieve specific goals in the learning process. Recognising and systematising these strategies brings about fundamental changes in the teaching, learning and assessment processes, optimising learning environments and improving the qualification of teaching work.

Learning strategies are mental tools that facilitate and improve the learning process.

Learning styles are about the way we learn, the way each of us employs a method or set of strategies. However, the specific practices we use vary depending on what we want to learn, each of us tends to develop a general preference, which means that we use some more than others, and this constitutes our learning style.

A learning style is therefore defined as the set of psychological characteristics, cognitive, affective and physiological traits that tend to be expressed together when a person is confronted with a learning situation. Some models of learning styles are mentioned below: Model (VAK), proposed by Richard Bandler and John Grinder (1988), is also called VAK (in reference to visual-auditory-kinaesthetic). It is part of the neurolinguistic programming for learning sensory reading of mental representation.

The types of learning according to VAK are divided into three cognitive learning systems. They determine the perception of the information that is received and processed mentally. Visual style: this learning style is part of the student's autonomous understanding. Since they learn knowledge visually, which allows the student to assimilate an action, without the need for it to be explained by the teacher in class. It is also the most practical and quickest type of learning. Auditory style: this method requires constant review. Because the student must mentally record each phrase and word described by the teacher, and then repeat it clearly and objectively.

Therefore, it consists of mental organisation and the recording of words of association between concept and object. Kinaesthetic style: this method is strengthened by habit. It involves remembering a process, action or concept.

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Using sensory information, there are many types of cognitive learning that are easy to assimilate because they are very extreme. For example, 'knowing that fire burns'. A single interaction is enough to assimilate it. But with behavioural learning processes at the academic level it takes a lot of practice. Kolb Model, the American psychologist David A. Kolb designed in 1984 a model of learning styles in which he theorised that there are three main agents that modulate the learning styles of each person.

These three agents are genetics, life experiences and the demands of our environment.

Over time, this model has become one of the most widely recognised and widely used assumptions about learning today. According to the learning style model developed by Kolb, when a person wants to learn something, he or she must process and work with the information he or she gathers.

In order for this information processing to be carried out optimally, four different phases must be completed. Concrete experience (CE), the immediate and specific experiences that lead to observation must take place. 2. Reflective observation (RO), the person reflects on what he/she is observing and develops a series of general hypotheses about what the information received may mean. 3.

Abstract conceptualisation (AC), abstract concepts and generalisations are then formed on the basis of these hypotheses. Active experimentation (AE), finally, the person experiments or practices with these concepts in other contexts or situations. When the person completes all these stages of the process, the sequence is restarted to continue acquiring more knowledge and information. **Likert scale:** This is mainly used to measure people's attitudes and opinions on various topics.

This tool is particularly valuable in social and market research, as it allows researchers to quantify individuals' perceptions and behaviours. By providing a series of statements with response options ranging from 'strongly agree' to 'strongly disagree', the Likert scale facilitates the collection of data that can be statistically analysed. This helps to identify trends, patterns and correlations in responses, providing a deeper understanding of the attitudes and opinions of the group being studied (Bloom, E. 2024).

Methodology

The research is non-experimental, documentary and descriptive. It is cross-sectional, because the information is collected at a single point in time. The procedures for the theoretical construction will be indicated, as well as the methodological and instrumental procedures that will be developed in the research process.

As far as fieldwork is concerned, it is used to obtain information on the indicators of the study variables, through the application of a set of techniques and instruments.

The purpose is to identify the teaching strategies applied in the subject of Quality Systems Management in the Industrial Engineering degree.

For this purpose, an instrument was designed through surveys (Questionnaire), to students and teachers who teach this subject, in order to identify areas of opportunity, evaluate the effectiveness of current methodologies and propose improvements that promote a more participatory and meaningful learning.

Specific questionnaires were designed for 81 students and 3 teachers, using the Likert scale to measure the level of agreement with statements focused on various aspects of teaching, such as pedagogical strategies, class activities, motivation, application of knowledge and proposals for improvement.

After applying the instrument, the information will be analysed to obtain the results. From the results obtained, a proposal will be designed to improve the learning strategies used by the teacher, which will have an impact on the improvement of the teaching-learning process.

Figure 1 shows the instrument applied to the students, and Figure 2 shows the instrument applied to the teachers.

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Box 1

5	I fully agree
4	Agree
3	Indifferent
2	Disagree
1	Strongly Disagree

No.	QUESTIONS	5	4	3	2	1
1	The current teaching strategies help me to understand the theoretical concepts of the subject.					
2	I consider that the teacher's theoretical expositions are sufficient to develop practical skills in the subject.					
3	The teaching strategies employed allow for an appropriate relationship between theory and practice.					
4	Teaching strategies promote the development of critical and reflective thinking.					
5	Learning strategies encourage the development of critical and analytical skills in the subject.					
6	The teaching strategies prepare me adequately to face the job challenges in the area of Quality Management.					
7	Teachers should update teaching strategies based on new pedagogical and technological trends.					
8	The teaching strategies used by the teacher in class encourage my ability to solve real problems in the industrial environment.					
9	The teaching strategies used by the teacher in class are repetitive.					
10	The use of practical activities (such as case studies or simulations) helps me to better understand the concepts.					
11	The group activities carried out in class strengthen my ability to work in a team.					
12	Evaluative activities encourage critical analysis of the topics studied.					
13	The evaluative activities encourage critical analysis of the topics studied.					
14	The activities proposed in class help me to stay engaged in my learning.					
15	Group activities should be implemented more frequently to encourage collaborative work.					
16	Do the teaching strategies used make the subject content interesting and relevant?					
17	The teacher currently has adequate teaching resources (videos, case studies, software) to teach the subject.					
18	The teaching strategies used make the subject content interesting and relevant.					
19	The classroom environment promotes participation and the exchange of ideas among students.					
20	I consider that the use of technological tools would improve the teaching-learning process.					
21	The incorporation of more practical activities or simulations would contribute to a better understanding of the subjects.					
22	It would be useful to have more didactic resources (videos, case studies, software) to improve the understanding of the concepts.					
23	The relationship between what is learnt in class and the needs of the world of work is clear and evident.					

Figure 1

Instrument applied to students taking the subject of Quality Systems Management

This survey aims to obtain a better understanding of the understanding of the current state of the teaching strategies used in the subject of Quality Systems Management in the Industrial Engineering degree. Your participation is essential to identify areas of opportunity, evaluate the effectiveness of current strategies and propose improvements that promote more active and meaningful learning. The information provided will be used exclusively for academic and research purposes to improve the quality of the teaching-learning process.

We thank you for your time and collaboration. GENDER H ( ) M ( ). Instructions: The questionnaire consists of several statements organised in sections. Please read each statement carefully and select the option that best reflects your opinion or experience, using the following scale

Box 2

5	I fully agree
4	Agree
3	Indifferent
2	Disagree
1	Strongly Disagree

No.	QUESTIONS	5	4	3	2	1
1	I frequently use lectures as my main teaching strategy.					
2	The teaching strategies I use allow for an adequate relationship between theory and practice.					
3	I believe that traditional teaching strategies are still effective in developing students' competences.					
4	Current teaching strategies make it easier for students to apply what they have learnt in industry situations.					
5	I regularly seek to update my teaching strategies with new methods or technologies.					
6	I consider it is important to take a course on Learning Strategies to learn about the latest pedagogical trends in Quality Management.					
7	I feel prepared to implement new student-centred learning strategies.					
8	The activities I implement in class facilitate students' understanding of abstract concepts.					
9	I regularly incorporate group activities to encourage collaborative work.					
10	I use case studies or simulations to link theoretical content with professional practice.					
11	The assessment activities I use allow me to adequately measure students' ability to solve real-world problems.					
12	. Practical or simulated activities are an essential component of my teaching strategy.					
13	The large number of students per group makes it difficult to implement collaborative					
14	implementation of collaborative activities in class.					
15	Class time is sufficient to implement active and student-centred teaching strategies.					
16	Individual student follow-up is difficult due to the size of the groups.					
17	The administrative burden and other responsibilities affect the possibility to innovate teaching strategies.					
18	I consider that the lack of technological resources limits the implementation of innovative strategies in my classes.					
19	I consider it necessary to increase the use of technological tools in the teaching-learning process.					
20	The incorporation of more practical activities would improve students' academic performance.					
21	It would be useful to design teaching strategies that promote more active and student-centred learning.					
22	More teaching resources (videos, software, case studies) would be valuable to enhance learning in the subject.					
23	Collaboration with other teachers would be useful to share good practices and innovative teaching strategies.					
24	The activities I implement allow students to develop critical competences in quality systems management.					
25	The current approach to the subject enables students to acquire the necessary competences to meet the challenges of the industrial environment.					
26	I consider that the current teaching strategies are aligned with the specific and generic competences of the Industrial Engineering programme.					
27	The learning strategies I used support the training of students adequately for the level of competences required by the industrial engineering programme.					

Figure 2

Instrument applied to teachers teaching the subject of Quality Systems Management

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This survey aims to gain a better understanding of the current state of the teaching strategies used in the Quality Systems Management subject in the Industrial Engineering degree. Your participation is essential to identify areas of opportunity, evaluate the effectiveness of current strategies and propose improvements that promote more active and meaningful learning. The information provided will be used exclusively for academic and research purposes to improve the quality of the teaching-learning process. We thank you for your time and collaboration.
GENDER H ( ) M ( )

Instructions: The questionnaire consists of several statements organised in sections. Please read carefully each statement and select the option that best reflects your opinion or experience, using the following scale

Results:

Once the two instruments had been applied to the 81 students and 3 teachers who teach Quality Systems Management in the Industrial Engineering course at the Villahermosa Institute of Technology, the following results were obtained. Survey applied to 81 students**:**

Box 3

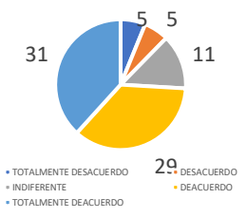

Figure 3

1.- The current teaching strategies used by the teacher help me to understand the theoretical concepts of the subject.

A total of 25 students totally agree that the teaching strategies used by the teacher help them to better understand the theoretical concepts of the subject, which represents 30.86%.

Box 4

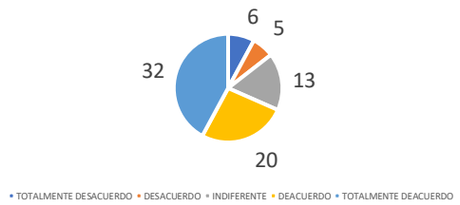

Figure 4

2.- I consider that the teacher's theoretical expositions are sufficient to develop practical skills in the subject.

43.21% of the students totally agree that the theoretical expositions of the teacher are sufficient to develop the practical activities.

Box 5

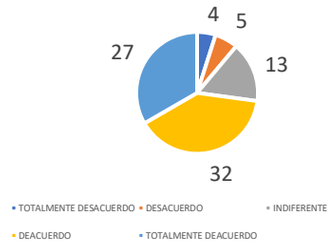

Figure 5

The teaching strategies employed allow for an appropriate relationship between theory and practice

A total of 27 students strongly agree that the teaching used by the teacher allows a link between theory and practice. This represents 33.33%.
Source: Own elaboration. 2024

Box 6

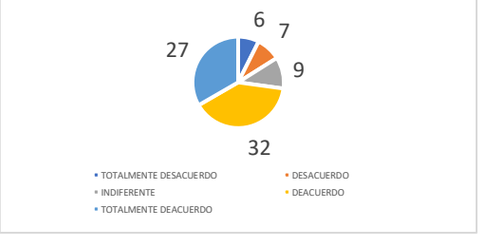

Figure 6

4.- Teaching strategies promote the development of critical and reflective thinking. 33.33% of the students fully agree, that the teaching strategies used by the teacher help to develop critical and reflective thinking.

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Box 7

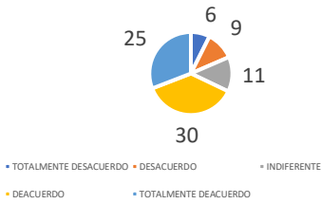

Figure 7

5.- Learning strategies encourage the development of critical and analytical skills in the subject area.

31 students strongly agree that learning strategies help to develop critical and analytical skills. This represents a 38.27%.

Box 8

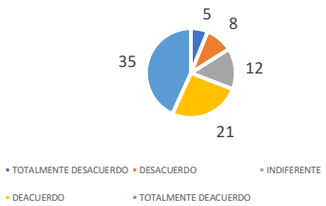

Figure 8

6. The teaching strategies prepare me adequately to face the challenges of working in the area of Quality Management.

39.50% of the students totally agree that the teaching strategies used by the teacher are supportive to face work challenges in the area of Quality Management.

Box 9

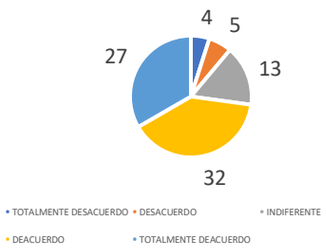

Figure 9

7. Teachers should update teaching strategies based on pedagogical and technological trends.

A total of 30 students, or 37.04%, strongly agree that teachers should use teaching strategies based on new pedagogical and technological trends.

Box 10

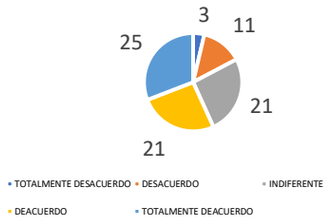

Figure 10

8. Teaching strategies used by the teacher in the classroom, foster my ability to solve real problems in the industrial environment.

30.86% of students consider themselves to be in complete agreement, that the teaching strategies used by the teacher foster their ability to solve problems they face in the industrial context..

Box 11

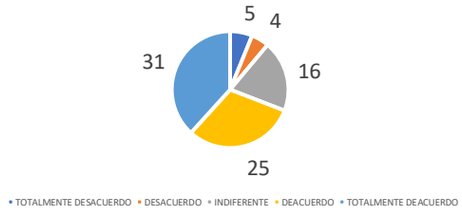

Figure 11

9.- The teaching strategies used by the teacher in class are repetitive.

A total of 21 students strongly agree that the teaching strategies used by the teacher are repetitive, which represents the highest percentage of students who agree that the teaching strategies used by the teacher are repetitive 25.93%

Box 12

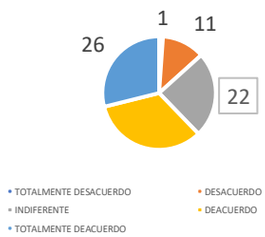

Figure 12

10.- The use of teaching strategies with practical activities (such as case studies or simulations) helps me to better understand the concepts.

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32.09% of the students strongly agree that the use of teaching strategies with practical activities helps them to better understand case concepts or simulations.

Box 13

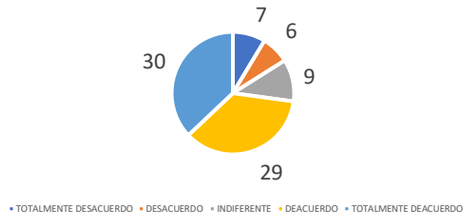

Figure 13

11. Group activities in class strengthen my ability to work as part of a team.

39.50% of students strongly agree that collaborative work activities in class strengthen their ability to work as a team.

Box 14

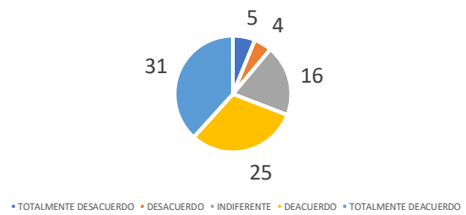

Figure 14

12. Evaluative activities encourage critical analysis of the topics studied.

A total of 31 students or 38.27%, strongly agree that the evaluative activities carried out by the teacher help them to foster their análisis critical of the issues that study.

Box 15

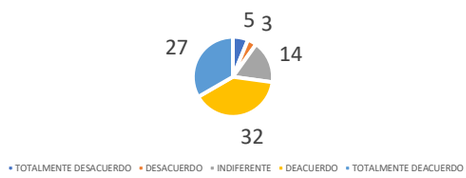

Figure 15

13. The teaching strategies used by the teacher motivate me to attend and actively participate in the Quality Systems Management class.

37.04% of the students strongly agree that the teaching strategies used by the teacher motivate them to attend their Quality Systems Management class.

Box 16

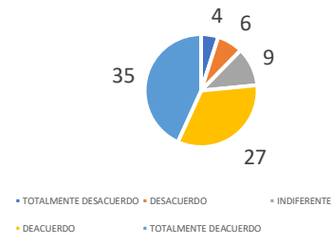

Figure 16

14. The activities proposed in class help me to stay engaged in my learning.

35 of students strongly agree that the activities in class help them to stay engaged in their learning. That is to say, 43.20% of them.

Box 17

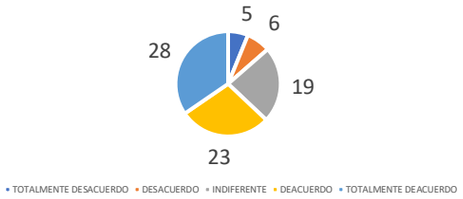

Figure 17

15. Group activities should be implemented more frequently in order to 34.56% of students strongly agree that group activities should be implemented more frequently to encourage more collaborative work..

Box 18

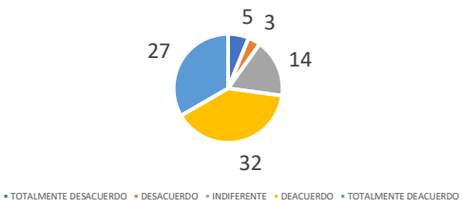

Figure 18

16. Do the teaching strategies used make the subject content interesting and relevant?

33.33% of the students strongly agree that the teaching strategies used by the teacher motivate them to make the subject content interesting and relevant.

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Box 19

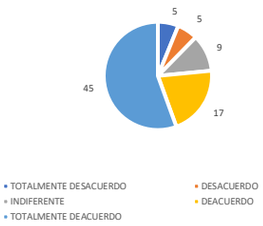

Figure 19

17. The teacher currently has the appropriate teaching resources (videos, case studies, software) to teach the subject of Quality Systems Management.

55.56% of the students totally agree that the teacher has the appropriate didactic resources (videos, case studies, software) to teach the subject of Quality Systems Management.

Box 20

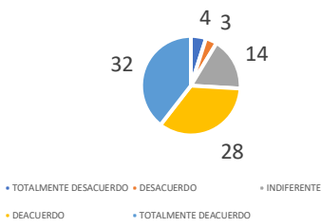

Figure 20

18. The teaching strategies used make the subject content interesting and relevant.

32 of students strongly agree that the teaching strategies used by the teacher make the subject content interesting and relevant. What the 39.51%.

Box 21

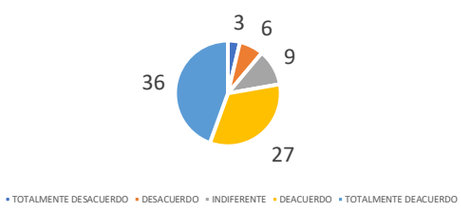

Figure 21

19. The classroom environment promotes participation and the exchange of ideas among students

44.44% of students strongly agree that the classroom environment promotes participation and the exchange of ideas among students.

Box 22

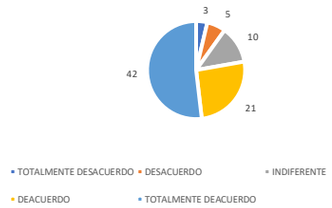

Figure 22

20. I believe that the use of technological tools would improve the teaching-learning process.

51.85% of the students consider that they totally agree that the use of technological tools would help to improve the teaching-learning process.

Box 23

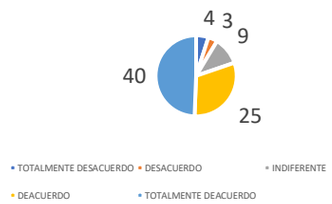

Figure 23

21. The incorporation of new Learning Strategies will contribute to a better understanding of the topics.

40 students strongly agree that the incorporation of new learning strategies will contribute to a better understanding of the topics. This represents 49.38% of them.

Box 24

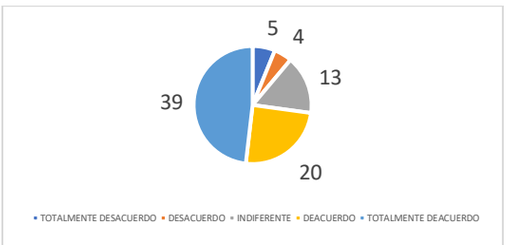

Figure 24

22. More teaching resources (videos, case studies, software) would be useful to improve understanding of the concepts.

A total of 39 (48.15%) students strongly agree that it would be useful to have more didactic resources to improve the understanding of the concepts.

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Box 25

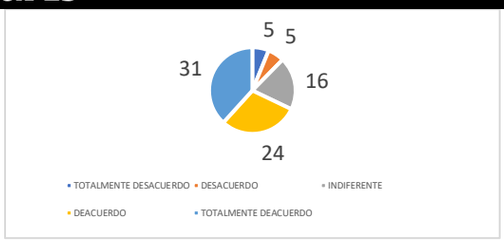

Figure 25

23. The relationship between what is learned in class and the

The relationship between what has been learned in class and the needs of the world of work is clear and evident.

38.27% of students strongly agree that the relationship between what they have learned in class and the needs of the world of work is clear and evident

From the survey applied to the students we can obtain striking results, which will help us to make good proposals to improve the learning strategies. It can be seen that 55.56% of the students consider that the teacher has the appropriate teaching resources (videos, case studies, software) to teach the subject of Quality Systems Management. And 51.85% of the students consider that the use of technological tools will help to improve the teaching-learning process. 49.38% of the students agree that the incorporation of new learning strategies can contribute to a better understanding of the subject. 48.15% of the students consider that more didactic resources should be made available to improve the understanding of the concepts.

Survey applied to teachers:

The following are some of the results of the survey applied to the three Teachers teaching the subject of Quality Systems Management.

Box 26

1

Figure 26

I frequently use lectures as my main teaching strategy.

33.33% of teachers strongly agree that they frequently use lectures as a main teaching strategy.

Box 27

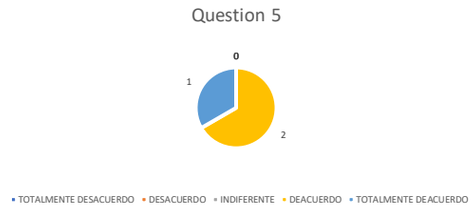

Figure 27

5. I regularly seek to update my teaching strategies with new methods or technologies.

33.33% of teachers regularly update their strategies, while 66.66% do not update their strategies.

Box 28

Figure 28

7. I feel prepared to implement new learner-centred learning strategies.

One third (33.33%) of teachers feel prepared to implement new student-centred strategies, while others may need further training or resources.

Box 29

Figure 29

12. Practical or simulated activities are an essential component of my teaching strategy

With 33.33%, some teachers see practical activities as a fundamental part of their teaching strategies.

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Box 30

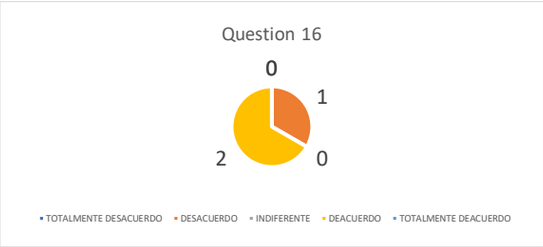

Figure 30

16. The administrative burden and other responsibilities affect the possibility to innovate teaching strategies.

66.66% of teachers agree that if they are affected by the extra administrative burden assigned to their teaching, it affects their ability to innovate their learning strategies.

Box 31

Figure 31

17. I consider that the lack of technological resources limits the implementation of innovative strategies in my classes.

66.66% of the teachers agree that. The lack of technological resources limits them to have innovative strategies in their classes.

Box 32

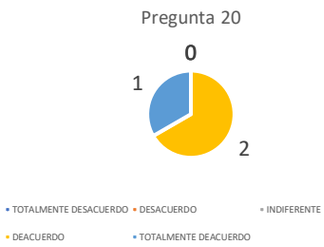

Figure 32

20. It would be useful to design teaching strategies that promote more active and student-centred learning.

66.66% of teachers agree that teaching strategies should be designed to promote learning..

Box 33

Figure 33

24. The current approach of the subject enables students to acquire the necessary competences to face the challenges of the industrial environment.

66.66% of the teachers do not agree that the students achieve the necessary competences to face the challenges of the industrial environment.

It is considered that 66.66% of the teachers do not update their teaching strategies. It can also be observed that 66.66% of the teachers agree that the extra administrative burden assigned to their teaching work does affect them, thus minimising their time to innovate their learning strategies. 66.66% of the teachers consider that the lack of technological resources limits them to have innovative strategies in their classes. Also 2/3 of the teachers agree that teaching strategies should be designed to promote learning. 66.66% of the teachers do not agree that students achieve the necessary competences to face the challenges of the industrial environment, so there is an opportunity to generate new learning strategies.
PROPOSAL.

From the results obtained, new proposals for learning strategies can be generated, which will strengthen the teaching-learning process for the students taking the subject of Quality Systems Management and, as a consequence, for the subjects of the Industrial Engineering course at the Instituto Tecnológico de Villahermosa.

Figure 3 shows the proposal for the application of new learning strategies. It is important in this proposal to consider the factors that affect the institution, both internal and external.

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A diagnosis should be carried out to determine the learning style of the students using the VAK Model and the Kolb Model (Theoretical Framework), in order to determine which learning strategies can be used in them and achieve greater knowledge and development of both specific and generic competences in the industrial sector. The teacher should update his or her teaching knowledge on learning strategies, so he or she should be given a course or courses.

The teacher should be supported with new technological resources. Once the teacher has these resources, and the learner's learning style has been identified. Then the teacher will design the learning strategies to be applied in the subject of Quality Systems Management.

Box 34

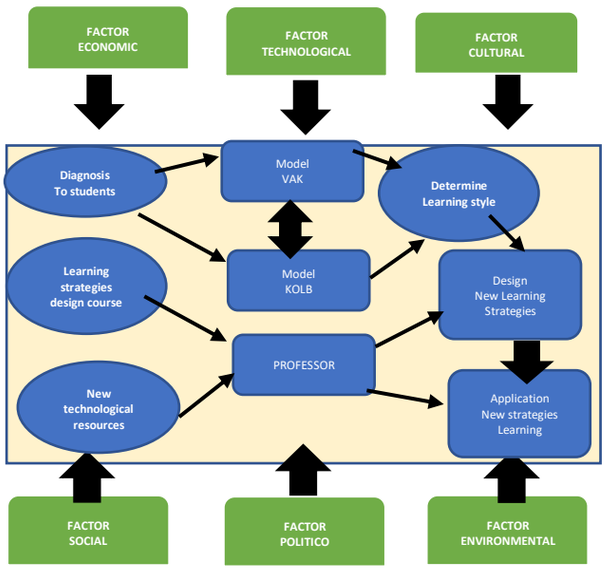

Figure 34

Proposal for the implementation of new learning strategies

Source: Own elaboration. 2024

It is important that this proposal considers the external factors that can affect an organisation, such as economic, technological, cultural, social, political and environmental factors. The economic factor can be considered in the study programmes developed in the institution, the resources necessary for the infrastructure needed to teach the classes. In relation to the technological factor, it is necessary for the institution to have up-to-date technology in laboratory equipment, computer centres, to mention a few.

The Cultural Factor influences the institution, maintaining relationship through the culture of a Entity that must be considered in the institution's extracurricular activities and in the institution's staff.

Objective of the Proposal:

To strengthen the learning experience of students in the subject and alignment with industry needs.

Educational Technology Implementation Strategy

Objective: To incorporate innovative educational technologies that facilitate hands-on learning, improve understanding of abstract concepts and align teaching with the technological demands of the industrial sector.
Specific Actions

Use of Simulations and Specialised Software. Industrial Simulations: Incorporate simulators of quality processes and industrial management in class so that students can experience real situations. Such as Statistical Process Control (SPC) models, where students can practice the use of graphs and analyse data.

Quality Management Software: Introduce programs used in industry as quality control tools, which are relevant to their professional development. Such as Minitab or Advanced Excel for data analysis: Facilitate the use of these programmes for statistical analysis, data interpretation and control charts. ERP (Enterprise Resource Planning) software to demonstrate how quality systems are integrated into resource and operations management. Quality document management systems (QMS) where students learn how to manage the documentation required in an ISO 9001 quality system.

Benefit: Exposure to these technological resources allows students to simulate and practice industrial processes in a controlled environment, which provides them with practical skills and helps them develop a better understanding of quality management concepts as applied to industry.

Multimedia Resources (Videos and Case Studies):

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Educational Video Library: create or select videos that explain key concepts, good practices in quality management and success stories in industry. This would include:

- Introductory videos on quality concepts (such as quality tools, cause-effect diagrams and continuous improvement processes).
- Recorded case studies showing practical situations, such as the implementation of a quality improvement on a production line.

Interviews with industry professionals to provide students with the integration of active methodologies, technological tools and collaborative resources that enhance theoretical understanding and the development of practical competences.

Benefit: These multimedia resources allow a better understanding of the concepts and offer a practical vision of their application in the work context, motivating students to learn through relevant and current examples.

Collaborative Platforms for Teamwork: Online Discussion Forums: Create forums within the institution's educational platform (such as Moodle, Google Classroom or Microsoft Teams) where students can ask questions and discuss class topics.

Collaborative Work Environments (Shared Documents and Collaboration Tools): Use tools such as Google Docs, Microsoft OneDrive, and Miro for students to work collaboratively on projects and case studies.

Benefit: These platforms encourage teamwork and collaboration, providing students with opportunities to improve their communication and collaborative skills, essential in today's workplace.

Updating Teaching Methodologies

Aim: To reduce reliance on traditional strategies and encourage an active and collaborative learning approach.

Proposed Actions: Adoption of Active Methodologies: Implement methodologies such as problem-based learning (PBL) and project-based learning, where students can work on specific projects in the quality industry.

Development of Collaborative Activities: Structure classes to include group activities and discussions, reinforcing the capacity for teamwork and the development of communication skills. Teacher Training in New Pedagogical Trends: Offer workshops to teachers on active methodologies and student-centred strategies to improve the updating of pedagogical strategies.

Benefits:

It will foster deeper and more autonomous learning, as students will be more active in the construction of their knowledge.

Strengthening Classroom Environment and Individualised Support

Objective: To improve the learning environment and provide more individualised support, especially in large groups.

Proposed Actions: Reducing the Administrative Burden for Teachers: Streamline administrative processes so that teachers have more time to prepare personalised activities and follow up on individual student needs. Implementation of Continuous Feedback Strategies: Create a constant feedback system in which students receive detailed evaluations of their progress and are motivated to improve.

Tutoring and Mentoring: Establish group and individual tutoring or mentoring sessions to cater to students who need additional support in understanding concepts and developing projects. Benefits:

It will create an inclusive and supportive environment, where students feel valued and their needs are addressed.

It will foster confidence and participation in class, improving academic performance.

Fostering Teacher Collaboration and Professional Development

Aim: To promote collaboration between subject teachers to share effective strategies and encourage continuous development.

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Proposed Actions: Creation of a Best Practice Exchange Programme: Establish regular meetings where teachers share experiences, teaching materials and strategies that have proven to be effective in teaching quality management. Access to Online Training and Resources: Provide access to online training platforms and specialised resources to help teachers keep up to date with new pedagogical and technological trends. Continuous Evaluation and Adjustment of the Proposal: Conduct periodic evaluations of the impact of the proposal on student achievement and teacher satisfaction, adjusting the plan according to the results obtained.

Benefits:

Teachers will be more empowered and motivated to innovate in their teaching strategies. It will foster a collaborative environment in which teachers can improve their practices and contribute to the success of the subject.

This design proposal responds to the areas of opportunity identified in the analysis of the student and teacher surveys. Incorporating technological tools, updating methodologies, strengthening the classroom environment and fostering teacher collaboration are key components that seek not only to improve the learning experience for students, but also to facilitate the work of teachers and ensure that teaching strategies are aligned with the competencies required by industry.

Conclusions

The results of this research have revealed a significant relationship between theoretical quality teaching strategies and their application in the Quality Systems Management classroom.

Theory suggests that the implementation of active methods and technological resources can enhance understanding and meaningful learning. However, in practice, both students and teachers pointed to challenges that hinder a full integration of these strategies, such as a lack of up-to-date methods and a shortage of specific technological resources. Although pedagogical theories stress the importance of student-centred teaching, the reality shows that administrative burdens and group sizes limit the possibility of personalised follow-up.

This highlights a discrepancy between the theoretical ideal model and the practical constraints encountered in the context of this research.

The research has achieved the objectives set out, as it has made it possible to identify and analyse students‘ and teachers’ perceptions of the effectiveness of current teaching strategies in the development of quality competences. It has also been possible to obtain specific information on the demand for new methodologies and technological tools to improve learning. The study also fulfilled its objective of proposing an improvement design for pedagogical practices, based on the evidence gathered. The proposal includes the implementation of simulations, case studies, active methodologies and the strengthening of the collaborative classroom environment.

One of the most outstanding findings is the high degree of acceptance of students for didactic resources (55.56%) and technological tools, as well as their interest in a practical education that prepares them directly for the work environment. This shows the relevance of digital and practical tools to facilitate applied learning in the area of quality.

With regard to the teachers, it stands out that 66.66% of them consider simulations and case studies to be effective in connecting theory with practice, highlighting the importance of these methods in the formation of competences. However, it is also observed that teachers encounter practical barriers such as the difficulty of implementing individualised activities due to external factors, such as group size.

Another salient point is the identification of areas where both students and teachers see opportunities for improvement in updating teaching strategies. This includes the need for methodologies to be better aligned with the technological and practical demands of the current work context.

Research Findings: Perception of Insufficient Innovation: Students indicated that teaching strategies are repetitive and could benefit from incorporating updated methodologies, suggesting an unmet demand for pedagogical innovation in the classroom.

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Valuing the Collaborative Learning Environment: Both groups value collaboration and the exchange of ideas, but students see a need to reinforce teamwork and practical activities to strengthen their quality management competences.

Declaearions

Conflict of interest

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

Authors' contribution

Sierra-Morejòn, Josè Luis: Contributed to project management and supervision. As well as in the design of the Proposal.

Javier-Gerònimo, Zinath: Contributed to the application of the instrument and the analysis of the information.

Morejón-Sánchez, Juana María: Contributed to the design of the methodology of this project.

Abid- Becerra, Marco Antonio: Contributed to the analysis of the information and the obtaining of results as well as recommendations in the design of the proposal.

Availability of data and materials

The data were obtained through field research, carried out with the professors who teach the subject of Quality Systems Management and the students who study the subject of industrial engineering. Tables were created with the information obtained.

Funding

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Abbreviations

ABP Project-based learning
CA Abstract 15onceptualization
EA Active experimentation
EC Concrete experience
ERP Enterprise Resource Planning
OR Reflective observation
VAK visual-auditivo-kinestésico)

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Background

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Text in TNRoman No.12, single space.

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

What is your added value with respect to other techniques?

Clearly focus each of its features.

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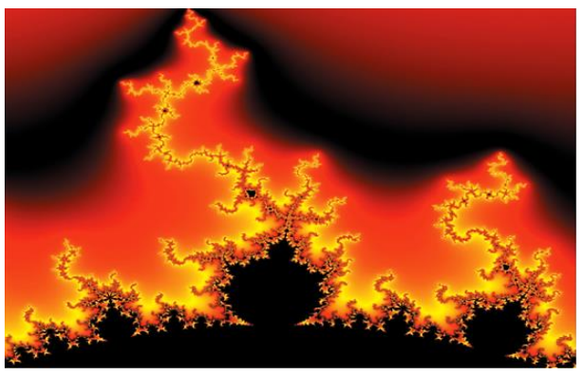

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$$Y_{ij} = \alpha + \sum_{h=1}^{r} \beta_h X_{hij} + u_j + e_{ij} \quad [1]$$

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Methodology

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

Results

The results shall be by section of the article.

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Clearly explain the results and possibilities of improvement.

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Tables and adequate sources.

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

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

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

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Indicate the availability of the data obtained in this research.

Funding

Indicate if the research received some financing.

Acknowledgements

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Abbreviations

List abbreviations in alphabetical order.

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ANN	Artificial Neural Network

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