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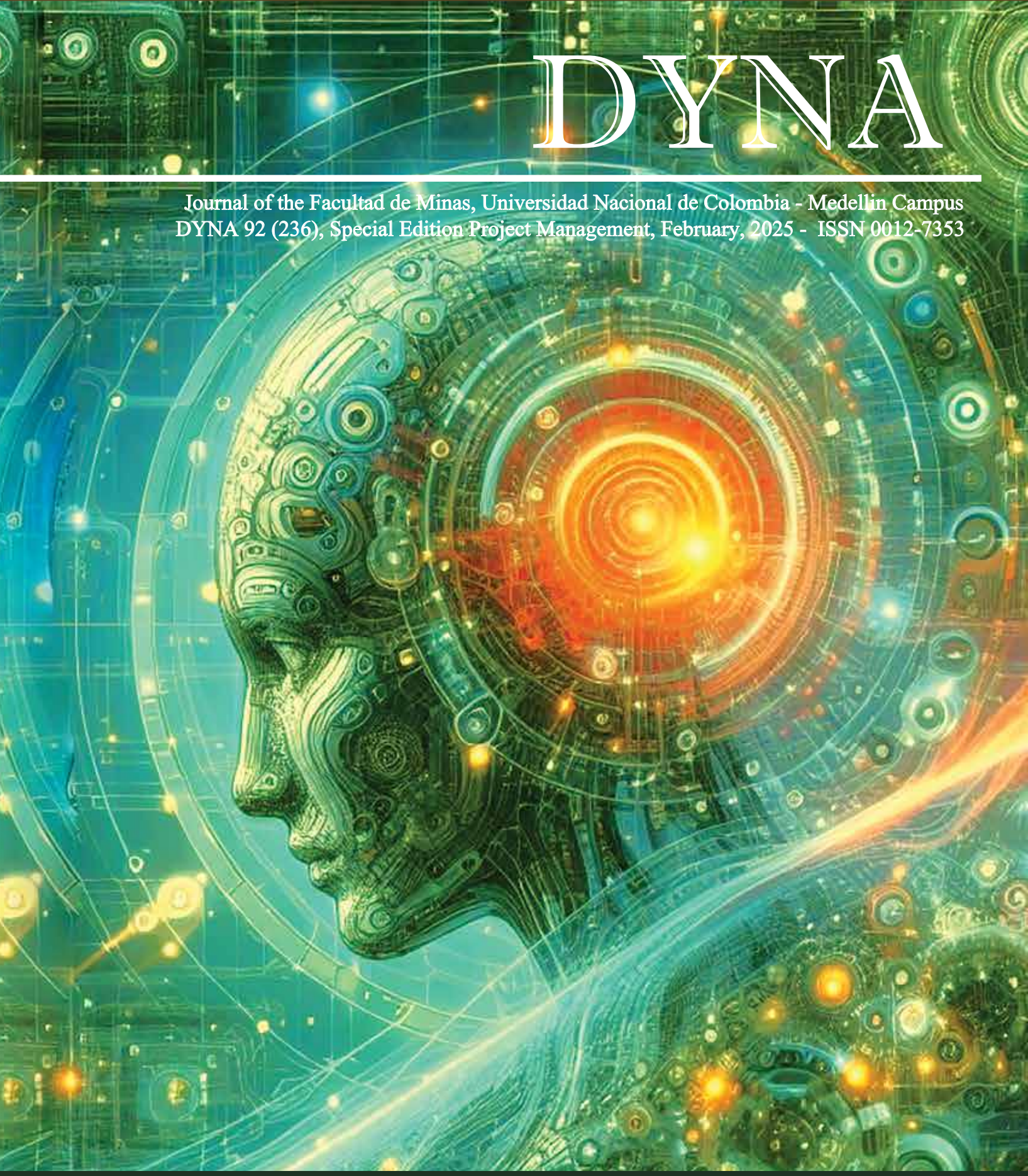

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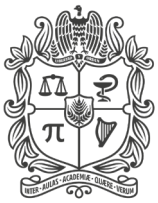

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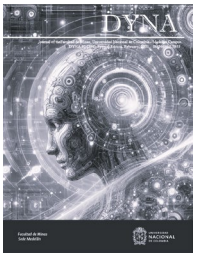

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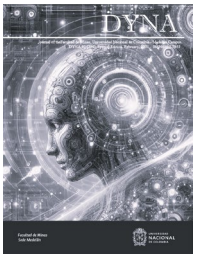

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Agile contracting as a mechanism to improve performance in business environments

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Abstract
During the initial phase of the Industry 5.0 revolution, agile methodologies have become crucial in companies, especially for projects that aim to establish a competitive advantage in this new era. The purpose of this research is to evaluate how flexibility in contractual clauses impacts the performance of agile projects, particularly in the context of Industry 5.0. Using a quantitative, exploratory, descriptive and cross-sectional approach; where, inclusion criteria were applied that considered only professionals with certifications in agile methodologies and proven experience in project management in public and private sectors. The final sample (100 participants) was selected from a universe of 1,000, ensuring representativeness by sector and management role. The analysis revealed that 82% of respondents believe that contractual flexibility significantly improves the achievement of project objectives, with the main factors being: 1) adaptability (72%); 2) flexibility (82%); 3) continuous learning (84%); speed (87%), teamwork (81%); and customer focus (87%) contribute to flexibility and collaboration among project participants contribute significantly to effectively meeting contractual conditions. In addition, the findings underscore the importance of rapidly improving the knowledge, skills and experience of staff in agile environments. The study advocates external support to accelerate the acquisition of contextual expertise, mitigate risks and foster a culture of innovation in organizations.

Keywords: project management; agility; contractual flexibility; business innovation; continuous improvement.

La contratación ágil como mecanismo para mejorar el rendimiento en entornos empresariales

Resumen
Durante la fase inicial de la revolución de la Industria 5.0, las metodologías ágiles se han vuelto cruciales en las empresas, especialmente para los proyectos que pretenden establecer una ventaja competitiva en esta nueva era. El propósito de esta investigación es evaluar cómo la flexibilidad en cláusulas contractuales impacta el rendimiento de proyectos ágiles, particularmente en el contexto de la Industria 5.0. Empleando un enfoque cuantitativo, exploratorio, descriptivo y transversal; en donde, se aplicaron criterios de inclusión que consideraron únicamente a profesionales con certificaciones en metodologías ágiles y experiencia comprobada en gestión de proyectos en sectores público y privado. La muestra final (100 participantes) fue seleccionada de un universo de 1,000, asegurando representatividad por sector y rol gerencial. El análisis reveló que el 82% de los encuestados considera que la flexibilidad contractual mejora significativamente el cumplimiento de los objetivos del proyecto, siendo los principales factores: 1) adaptabilidad (72%); 2) flexibilidad (82%); 3) aprendizaje continuo (84%); velocidad (87%), trabajo en equipo (81%); y enfoque al cliente (87%) contribuyen con la flexibilidad y la colaboración entre los participantes en los proyectos contribuyen significativamente a cumplir eficazmente las condiciones contractuales. Además, las conclusiones subrayan la importancia de mejorar rápidamente los conocimientos, las habilidades y la experiencia del personal en entornos ágiles. El estudio aboga por el apoyo externo para agilizar la adquisición de experiencia contextual, mitigar los riesgos y fomentar una cultura de la innovación en las organizaciones.

Palabras clave: gestión de proyectos; agilidad; flexibilidad contractual; innovación empresarial; mejora continua.

1 Introduction

In the digital era, technology has significantly altered our daily activities and the way we interact with the world. This transformation extends to the development of products, goods, and services through projects. According to van Rooij [1], the term 'project management' has replaced 'project administration', emphasizing the efficiency of interacting

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processes and the critical role of resource management. Effective resource management ensures that projects adhere to predefined time, cost, and scope constraints. Although procurement management encompasses equipment, supplies, materials, solutions, services, and labor, offering a comprehensive scope for organizations, project managers often lack sufficient authority to manage contracts effectively due to the organizational hierarchy. This responsibility typically falls to roles experienced in the legal aspects of contract management. Companies usually define roles with the requisite authority to handle contracts, delineate their limits, and outline the procedures for managing terms and conditions per established rules. Contracts serve as formal mechanisms for agreements between involved parties [2]. Turner and Simister [3] note that while contracts have become a reliable and effective means to facilitate transactions, their implementation poses challenges, particularly in dynamic environments.

Moreover, PMW [4], Tatikonda and Rosenthal [5], Mirza and Ehsan [6] in their reports, highlight that execution remains a major challenge. Frequent environmental changes, driven by uncertainty, complicate the management and adherence to established contractual terms. However, Treadgold and Reynolds [7] argue that adopting an agile approach could satisfy project deliverables more effectively, as it allows for flexible task development among stakeholders, considering established contractual constraints. Dal Mas, et al. [8], Thorup and Jensen [9], Franklin [10] suggest that contracts should foster communication between stakeholders to ensure obligations are met and focus on business value to enhance collaboration and performance.

Implementing an agile contract within an organization presents significant challenges. Lindsjørn and Moustafa [11] found that agility in contracts requires flexibility in scope, necessitating trust with the client. Ekasari, Raharjo and Prasetyo [12] identified coordination, autonomous team management, team maturity disparities, and distributed teams as major challenges within agile contracts, all falling under collaboration and communication. Baxter, et al. [13] argue that an effective agile contract demands commitment and a unified team culture to adapt to environmental changes. Nuottila, Aaltonen and Kujala [14] noted the difficulty in adopting and effectively implementing agile principles, calling for a paradigm shift in organizations to embrace transparency, inspection, and adaptation. This study aims to contribute to the state of the art by examining whether agile contracts can enhance project deliverable performance through the flexibility of contractual conditions, thereby adding value to business objectives.

2 Literature review

In the realm of procurement management within a project, the acquisition of products, goods, and services are contemplated, according to the needs that a project may have throughout its life cycle [15], being contracts the tools that allow regulating the terms and conditions to manage procurement, maximizing the operational-financial performance and mitigating the associated risks during the performance [16]. Ibem and Laryea [17] identify that in project management there are the following types of contracts: 1) typical contracts, associated with works concession, service concession, services, and supply; 2) mixed contracts, which combine in their object different services of typical contracts; and 3) special administrative contracts, whose purpose is the general interest. Rejeb, et al. [18] state that depending on the legal regime, a distinction must be made between contracts subject to harmonized regulation and contracts under administrative or private law.

Turner and Simister [3] identified that the selection of contract type, within the procurement process, is related to the uncertainty in the project outcomes and its delivery process; if the uncertainty, then the risk is low, and fixed-price contracts are best; but if the uncertainty increases, then the risk increases and the contracts should be changed to a variable model. Jarzębowicz and Weichbroth [19] identified that in turbulent environments, customers demand the fulfillment of critical requirements with higher-than-expected performance to obtain accelerated results and ensure the success of the strategy early.

Baldi, et al. [20] identified that in a procurement process for a project, the following procedures should be considered: 1) Request for information to gather market information from a set of selected suppliers; 2) Request for proposal, used in the case of a complex scope, where the buyer is looking for the supplier to provide a solution; and 3) Request for quotation, used when price is the main deciding factor and the proposed solution is readily available. Frederico [21] mentions that the processes to be considered in procurement management should ensure the identification, validation, and confirmation of the terms and conditions of the project scope between the interested parties (buyer and seller).

Conversely, Ng and Navaretnam [22] identified that procurement has typically focused on purchases per se, examining issues such as outcomes and implementation challenges; but incorporating the agile mindset in the process expands the knowledge base of the company, obtaining reductions in inertia and improving its viability for future products, goods, and services, which over time will be reflected in continuous process improvement, giving room for the definition of an agile contract. Jay [23] mentions that to successfully achieve strategic goals it is necessary to identify specific situations, then establish a prioritization process, and an action plan and assign roles with their responsibilities; to ensure efficient and effective decision-making for the organization.

However, the use of approaches, methodologies, and standards is considered best practice in project management, with traditional approaches (waterfall) and agile methods being the most widely used today, alongside hybrid models that facilitate the transition from traditional to agile models [24].

Cutting-edge technologies have given way to new business models that could only have originated in the digital era. As a result, companies are transforming and will have to adapt to this new reality [25]. Today, many organizations face both an opportunity and challenge to innovate with products, processes, or technologies in a changing and disruptive environment. This approach to business agility has created an opportunity for organizations to be adaptable

through the approach of business agility, which has led to the creation of competitive advantage over the short, medium, and long terms [26,27].

Business agility is a relatively new paradigm that is presented as a solution to maintaining competitive advantage in times of uncertainty and turbulence in the business environment [28]. An agile mindset is defined by Ozkan and Gök [29] as possessing a quick, resourceful, and adaptive character. Thus, agile organizations are quick to respond, resourceful, and able to adapt to their environment [30].

Speed refers to the rate at which an organization can respond to customer requests, market dynamics, and emerging technological options; this includes the time to perceive relevant events, the time to interpret what is happening and assess the consequences for the organization, the time to explore options and decide what actions to take, and the time to implement appropriate responses [31]. Resources refer to the capabilities available in the organization, including people, technology, processes, and knowledge. Resources can be both tangible and intangible and provide the basis for doing business and for instantiating change [32,33]. Adaptability refers to the organization's ability to respond to changing demands, threats, or opportunities. This requires learning capability, as well as flexible processes and products that can be reconfigured without large additional costs [31,34].

Agility is about economies of scope rather than economies of scale [34]. While lean operations are often associated with efficient use of resources, agile operations are related to responding effectively to a changing environment while remaining productive [35]. The idea is to serve increasingly smaller market niches and individual customers without the high cost traditionally associated with customization [36]. Agile organizations are not only able to successfully implement change; they are agile and able to respond quickly and elegantly to both expected and unexpected events in their environment [35].

The concept of agility emerged from lean and flexible manufacturing [34,37], and has been rapidly adopted by organizations producing software in the form of agile systems development [38,39]. Therefore, for the use of these empiric methods within procurement processes to be fast and effective, organizations must consider customer needs, budget, technology, and data-driven business intelligence to improve performance, reduce cost, and minimize risk in a changing environment [40].

Additionally, AlOmar, et al. [41] state that for the success of an agile contract, flexibility must be established in the contract clauses to promote collaboration between stakeholders and the project team, generating a cadence between strategy and execution, through agility. While, Shams, et al. [42], Gupta, Agrawal and Ryan [43], Vermeulen and Barkema [44] agree that the contract structure should consider at least the following variables: 1) time and materials; 2) fixed price per sprint; 3) fixed cost per story point; and 4) fixed price based on results.

Gupta, Agrawal and Ryan [43] emphasize that, in the time and materials domains, a relationship between the stakeholders and the team must be flexible to promote continuous improvement in the process through the principles of communication, transparency, and trust of those involved. In the fixed price per sprint scenario, the relationship of trust between stakeholders predominates, delegating to the team executing the contract the responsibility for the quality and volume of deliverables for each sprint [42].

On their side, Vermeulen and Barkema [44] highlight in the fixed cost per story point scenario, that the remuneration is directly proportional to the complexity of the work provided, being suitable for projects with a mutual understanding among those involved of the value to be obtained; but it is important to take into consideration the mechanism to be used for pricing based on the scope of the service offered. Finally, outcome-based fixed pricing is characterized by the provider to achieve the agreed outcome [42-44].

Turetken, Stojanov and Trienekens [45] state that to achieve success in a contract, parties involved must share responsibilities to validate the uncertainties in the scope, time, cost, and quality of the product or services to be delivered. Hence, the customer must understand the requirements and obligations; and the supplier needs to validate the knowledge, experience, and expertise for the execution of the object of the contract. Additionally, Uludağ, et al. [46], state that, when establishing the clauses of a contract, these shared responsibilities should address: 1) Knowledge of the initial vision and route time; 2) Identification of the Minimum Viable Product (MVP) and the potential characteristics for its continuous improvement; 3) Criteria for prioritization of the initial backlog in planning; 4) Definition of the scope of the initial solution; 5) Roles and responsibilities of the service execution team; and 6) Establishment of the financial framework according to the contractual terms. AAnwar and Abdullah [47] mention that the basis of a contract should include the direction and expected results, being necessary for those involved to plan in detail each interaction in the tasks to be performed, to ensure active engagement and alignment throughout the execution of the iteration.

After each interaction, an evaluation of the performance obtained is carried out through the collection and analysis of metrics, allowing more accurate decision-making, to establish continuous improvement strategies, within a dynamic and iterative context [48]. Al-Saqqa, Sawalha and Abdelnabi [49] called this event the inspection and adaptation of the solution according to the contract, which is aimed at ensuring the success of the scope and according to the objectives. Noteboom, et al. [50] identified that, through an agile approach, flexibility is provided in the terms and conditions of service contracts; impacting boosting collaboration, self-management, motivation, and courage of work teams, allowing to redefine work priorities according to the context and customer requirements, without modifying the terms and conditions within the contract.

Kula, et al. [51] proposed a model to identify the critical factors for on-time delivery of products within an agile approach, where, as part of the contract scope, they established a fixed price for user stories, regardless of their size, then the stories are incorporated into the sprint for the definition of the initial investment and provide the customer

with the value of the feature versus the expense, as a tool for decision making, which allows customers to pay only for those features that provide value to the business. Nicoletti [52] identified that by adopting a scrum method as an operating model for a cross-functional contracting team, agility, and alignment were improved, which allowed companies to remain highly adaptable, since, by involving a multidisciplinary team, collaboration, self-management, and help among all collaborators were fostered, bring benefits for the whole team and improving performance and cost.

3 Research methodology

This research employed a quantitative methodology to examine causal relationships within a specific population, thereby enabling hypothesis validation [53]. It combined exploratory and descriptive approaches to discern the primary characteristics that drive continuous improvement in the procurement processes of products, goods, and services, utilizing a flexible contracting model [54]. Additionally, a cross-sectional approach was implemented to observe the phenomenon's behavior at a particular moment in time [55].

A sample of 1,000 project management professionals was selected, comprising individuals in managerial roles across both public and private sectors in Costa Rica during 2023. These professionals were actively leading projects using agile methodologies at the time of the study. From this group, 100 professionals responded accurately and successfully to the survey. The sample size was determined using a finite population model, facilitated by access to an open database of expert professionals, provided by CERTIPROF, LLC, a certified and internationally recognized entity in this field. Data collection was conducted via a closed survey, distributed by email to maximize efficiency in terms of time, cost, and ease of response. The survey included a 5-point Likert scale for responses, with some questions offering single or multiple-choice options to gather detailed data for the study and describe the sample accurately.

Following data analysis, the research tested the proposed hypothesis, which is stated as follows: "The adoption of agile methodologies enhances the performance of deliverables in project contracts for products, goods, and services, through the influence of flexibility in the contractual clauses."

The objective of the present study was to evaluate the degree of consensus among the experts surveyed. The hypothesis was evaluated using the correlation coefficient, a statistical measure that provides insights into the strength, degree, and direction of relationships between variables. In this case, a positive correlation indicates that two variables change in the same direction, with the coefficient ranging from 0 to 1, where 1 signifies the strongest possible association [56-58].

4 Results

Fig. 1 shows descriptive information on the distribution of the participant's experience in the field of agility.

As illustrated in Fig. 1, the distribution of experience among the interviewees in agile project management is as follows: 48% possess over five years of experience, 31% have between two to five years, and 21% have less than two

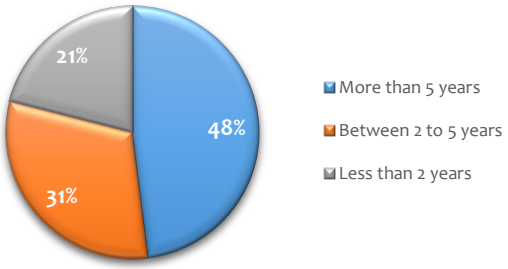

Figure 1. Distribution of experience in the field of participant agility
Source: Own Elaboration.

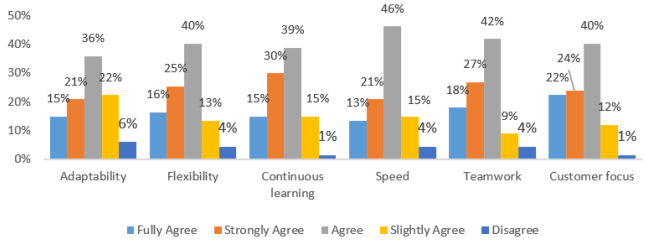

Figure 2. Perception of the contribution of agility as a mechanism for improving contract performance.
Source: Own Elaboration

years. This diversity in experience levels indicates that the sample adequately represents the knowledge and expertise relevant to the phenomenon being studied. Terzieva [59] highlights the importance of knowledge management in project environments, emphasizing that the practice of learning from both failures and successes plays a crucial role in capturing, sharing, and preserving knowledge over time. As depicted in Fig. 2, illustrates respondents' views on how agility contributes to enhancing the performance of the terms and conditions in contracts for products, goods, and services. Worley, Williams and Lawler III [60] pinpoint several factors that improve contract performance in an agile setting, including 1) Adaptability, 2) Flexibility, 3) Continuous Learning, 4) Speed, 5) Teamwork, and 6) Customer Focus.

Fig. 2 presents the respondents' perceptions on the effectiveness of agile methods in contract management, with the majority agreeing or strongly agreeing on several key aspects: 1) Adaptability: 72% of respondents report that agility enhances contract adaptability. 2) Flexibility: 82% believe that increased flexibility improves result delivery. 3) Continuous Learning: 84% acknowledge that continuous learning fosters improvements in contract management. 4) Speed: 87% confirm that agility accelerates delivery times. 5) Teamwork: 81% recognize that agile methods facilitate and enhance operational efficiency. 6) Customer Focus: 87% note that these methods increase visibility and transparency regarding customer requirements. Collectively, these responses underscore the consensus that agile methodologies significantly enhance contract performance.

Ng and Navaretnam [22], Algarni [56], Linders [61] concur that agile methods equip project teams with additional skills, capabilities, and tools essential for efficient contract management and ensuring the fulfillment of project objectives with anticipated value.

Furthermore, the research measured the degree of

Table 1.
Results of Spearman's correlations independent variables

Dependent Variable		Hypothesis Testing Model	Independent Variables
		Spearman's	Level of influence of the flexibility factor on the terms and conditions set forth in the contract clauses
Question	The use of agile methods allows to improve the performance of deliverables in a project contract for products, goods and services.	Correlation Coefficient (Bilateral) Sig.	0,72
		Sig.	0,3
		N	100

Source: Own Elaboration

consensus among the experts via the correlation coefficient to test the proposed hypothesis. Alzina [62] explains that correlation provides insights into the intensity, direction, and degree of relationship between variables. In this context, a positive correlation occurs when two variables change in the same direction; the strength of this relationship is indicated by a coefficient ranging from 0 to 1, with 1 denoting the strongest relationship. This analysis is characterized as non-parametric, suitable for testing hypotheses concerning quantitative data populations, particularly when the distribution is uncertain.

The study utilized Spearman's rank correlation to assess the connection between two variables. According to Kendall and Smith [63], this coefficient evaluates the degree of correlation across multiple variables. Table 1 encapsulates the most significant correlations, both negative and positive. Following Alzina [62] classification, these range from negligible to low. For analytical purposes, the research primarily focused on positive correlations, reflecting the core interests of the study and highlighting the significant relationships between dependent and independent variables.

In analyzing the dependent variable (agile method), the positive associations with the independent variables (factors as adaptability, flexibility, continuous learning, speed, teamwork, and customer focus) were interpreted. The p-values associated with the null hypothesis's test statistic were 0.6 and 0.8, respectively, indicating a significant correlation between the variables. Consequently, the hypothesis suggesting a strong interrelation can be confidently accepted.

The hypothesis testing corroborates the findings, demonstrating that implementing an agile approach—particularly through enhancing flexibility—can significantly improve contract performance. Gupta, Agrawal and Ryan [43] further assert that managing a project with an agile approach not only boosts performance but also fosters continuous improvement. This approach encourages a close connection between the project and the organization as a whole to consistently deliver value by incentivizing ongoing enhancements.

1 Discussion

Project management is associated with procurement, the latter establishes the policies to enter into a contract and the processes derived from these, being contracts the mechanisms used to establish the agreements between the parties involved and are also tools established to regulate the management between stakeholders [2,24]. On the other hand, agility has to do with economies of scope, which determines the types of contracts that are required and how they should operate in the life cycle of projects [64].

The use of agile methods within procurement processes must be fast and effective, which is why the orientation towards the client and knowing their requirements specifically should focus on the efficient use of budget, technology, and information to improve the performance of the processes involved [65]. This also means that the clauses used in contracts should be flexible and adaptable to the needs of the environment.

In the construction of agile contracts, it is important to consider how the client's requirements adapt to the needs of the environment, the work team is flexible in its design and execution, and there is a focus on continuous improvement from the internal processes to its monitoring and control. There is also a team committed to the goals established and the products to be delivered.

All of the above factors give room for the agile approach requires that stakeholders be more involved in providing feedback on the deliverables in each interaction, prioritization of tasks, and the value that can be provided in the face of change, being the success of a project or service is ultimately determined by the level of continuous collaboration between the buyer and the seller. Therefore, the present study seeks to assess the level of perception at the enterprise level and determine whether agile contracts can generate this collaboration in an agile environment, through collaboration, flexibility, and adaptability of processes.

Tam, et al. [66] identified that the factors of teamwork capability and customer involvement can favor the deliverables in an agile project; Pacagnella Junior, Romeiro da Silva and Aquino Junior [67] identified that factors such as teamwork, flexibility in the organizational culture and project adoption capability are key to the success of a project. This evidences that the operational factors applied to the execution of a project are also applicable to contract management, giving a systemic scope within an empirical environment.

Finally, it highlights the need to streamline the processes of knowledge building and, the experiences of collaborators in agile environments to ensure their proper use and foster an appropriate relationship with the environment.

2 Conclusions

The study confirmed a positive impact of agility on the performance of contract terms and conditions throughout their lifecycle, establishing a causal relationship between

agility and contract performance in the creation of products, goods, and services. This influence adds significant value to the organization. The data revealed that respondents view flexibility and collaboration among project participants positively, which in turn positively affects the predefined objectives.

Participants concurred that agile methods equip project teams with additional skills, abilities, and tools for effective contract management, aiding in achieving set goals and objectives. There is a strong correlation between the expertise of agile project professionals and their understanding of agile contracts and their outcomes. Furthermore, from the perspective of the users, traditional project contract management has evolved into a process that is both more agile and efficient. It is essential to expedite user experiences in agile environments, enhancing their knowledge to effectively transform project contracting processes into overall management catalysts.

The practical implications of these findings advocate for a shift towards embracing business agility in the digital era, positioning it as a guide to ensure the success of individuals, companies, and society at large. The results offer a strategic roadmap for stakeholders to foster information-driven decision-making in an uncertain environment. From a theoretical perspective, the implications encourage academic research to further explore the relationship between process and procedure in business agility and the resilient role of stakeholders in the digital age. This ensures a diverse future research trajectory as the subject is contemporary, extensive, and multifaceted.

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From strategic planning to agility: strategic management approaches

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Abstract
Strategic management is fundamental to business development, but traditional strategic planning has lost its value due to uncertainty and constant market changes. Therefore, a new strategic paradigm known as agility has emerged, which promises to generate adaptation and sustainability for companies. The overall objective of this document is to examine strategic planning and organizational agility approaches, in order to understand how these paradigms can contribute to business advancement in dynamic and changing environments. A systematic review of the literature in scientific databases was carried out to achieve this. Expected outcomes include identifying differences between traditional strategic planning and organizational agility, understanding how agility can generate business adaptation and sustainability, and its implications in competitive environments. In conclusion, agility is essential for adaptation and sustainability, promoting dynamic strategies and skills such as problem solving and collaboration, improving business performance.

Keywords: project management; strategic planning; strategic agility.

Desde la planeación estratégica a la agilidad: enfoques de gestión estratégica

Resumen
La gestión estratégica es fundamental para el desarrollo empresarial, pero la planificación estratégica tradicional ha perdido su valor debido a la incertidumbre y a los constantes cambios del mercado. Por ello, ha surgido un nuevo paradigma estratégico conocido como agilidad, que promete generar adaptación y sostenibilidad para las empresas. El objetivo general de este documento es examinar los enfoques de planificación estratégica y agilidad organizativa, con el fin de comprender cómo estos paradigmas pueden contribuir al avance empresarial en entornos dinámicos y cambiantes. Para ello, se ha llevado a cabo una revisión sistemática de la literatura en bases de datos científicas. Los resultados esperados incluyen la identificación de las diferencias entre la planificación estratégica tradicional y la agilidad organizativa, la comprensión de cómo la agilidad puede generar adaptación y sostenibilidad empresarial, y sus implicaciones en entornos competitivos. En conclusión, la agilidad es esencial para la adaptación y la sostenibilidad, promoviendo estrategias dinámicas y habilidades como resolución de problemas y colaboración, mejorando el rendimiento empresarial.

Palabras clave: gestión de proyectos; planificación estratégica; agilidad estratégica.

1 Introduction

Today, strategic management has become a key component of business development and survival. Traditional strategic planning (SP) has established itself as a fundamental approach for management to make decisions and guide operations [1,2]. However, this strategic approach that integrates company policies, systems and processes is considered "hard" in the face of rapidly changing markets and increasing uncertainty. The need has therefore arisen to implement a more dynamic and adaptable approach, in line with the idea of organizational agility [3].

However, the concept of agility in both academic literature and business practice has not been clearly defined. This leads to confusing terms, such as strategic agility and organizational agility. Agility does not refer to using a tool,

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instrument or framework for project management, nor is it only linked to external changes. Rather, it is a managerial quality or strategic guideline of an organization continuously seeking to evaluate its products and processes, in order to remain in the market and generate sustained growth over time. This is known in literature as dynamic capacities [4,5].

In this context, it is crucial to explore the contributions of traditional SP and strategic agility approaches that provide companies with the tools and resources they need to meet current and future challenges. The business environment is constantly changing, and companies need to retain the capacities that help them adapt or anticipate as best they can through a solid strategic approach aimed at achieving their long-term objectives.

2 Methodology

A systematic literature review was developed to collect and analyze relevant studies on the topic of traditional strategic planning and strategic agility. The consulted databases were Scopus, Web of Science and Google Scholar, using keywords, such as "strategic planning," "traditional planning," "strategic management," "strategic agility," and "organizational agility."

The following selection criteria were taken into account to conduct the literature review: they had to be scientific articles reviewed by academic peers; their publication dates had to be from 2019 to date, with the exception of earlier relevant articles; they had to be written in English; and they specifically had to address the topic of strategic planning and organizational agility.

The initial search yielded a total of 150 relevant articles. Their titles and abstracts were reviewed to determine whether or not they met the selection criteria. After this process, 57 articles were selected for a full reading and detailed analysis. A thematic analysis approach was used to analyze the selected articles, identifying patterns and trends in the different studies' findings and conclusions [6]. The 57 selected articles were read a second time, and a summary was developed for each one of them. They were included in each corresponding analysis category.

3 Literature review

Today, businesses are undergoing constant change due to the incorporation of new technologies and business procedures. As a result, companies cannot make decisions based on predictions, management intuition or unforeseen actions [7]. Strategy has emerged as the set of managerial decisions and actions, which involve formulating, planning, implementing, evaluating and controlling processes to achieve the desired objectives [8,9].

The long-term objective of strategy is to improve an organization's performance. Therefore, strategy is based on studying the internal strengths and weaknesses of a company, with which it can monitor and evaluate external opportunities and threats [10]. The etymology of the word strategy comes from the Greek "strategos" which means "general" in a military context. In business, it can also be understood as "management" or "planning," and it focuses on understanding the competitive environment and how these factors can affect a company [11].

According to [12], strategy involves establishing a company's long-term objectives and goals, as well as taking actions and allocating the necessary resources to achieve these objectives. Meanwhile, [13] consider the plan that defines a company's activity, its markets, the needs to be satisfied and the products to be offered. An effective strategy is based on objectives, the ability to make risky decisions, the search for commercial opportunities and the desired behavior of the markets.

For [14], strategy involves choosing the activities in which a company excels, in order to establish a sustainable competitive advantage. On the other hand, [15] assures that it is composed of four elements that make up a unit. The mission responds to the purpose of the organization, establishing its business, market and public image. The vision defines the company's desired future and motivates the entire organization to achieve it. Values are the principles and standards that guide management. Objectives are goals to be achieved within a given time frame. Organizational culture and philosophy are derived from these components.

However, the term "strategy" has been used rather loosely in recent decades, which has led to the lack of a single definition. Consequently, several generic approaches have been developed that offer multiple perspectives on the purpose of strategy and ways to achieve it [11,16,17].

[18] states that there are three types of generic strategies: cost leadership, differentiation and focus. A company that follows a cost leadership strategy focuses on minimizing costs and implementing strict cost controls. The differentiation strategy involves creating unique and distinctive products or services valued by customers because of their special characteristics. Meanwhile, the focus strategy focuses on a specific market segment or niche where the company can serve the particular needs of that market more effectively than other competitors.

On the other hand, [19] defines the concept of strategic management as the art and science of making decisions that link different functionalities and help the organization meet its objectives. They present business strategy as the company's plan to achieve a competitive advantage in the marketplace. Strategic management is a continuous process that involves analyzing strategic goals, the organization's internal and external environment, and the decision-making and actions to create and maintain competitive advantages.

[16] also state that there is a dichotomy in academic research between rational versus incremental planning. The rational school of thought believes a core group of company managers deliberately formulates strategies. The incremental school of thought believes strategy emerges within a firm through its day-to-day activities. In practice, strategic planning can arise from a logical process, as described by the rational school of thought, or be described through the company's activities and its results, as stated by the incremental school of thought.

Moreover, [11] propose two approaches to strategy: general strategy and company strategy. The former focuses on planning, resource allocation and profitability as pillars of the traditional approach, while the latter complements it and

directly involves managers or leaders.

Successful execution depends on the functions of senior management and organizational project management, and is also used in task leadership, decision-making, coordination and communication of strategic objectives.

The environment is now dynamic and changing, which demands adaptability, flexibility and responsiveness from companies. Agile environments require a re-evaluation of traditional strategic planning methods and adopting more flexible and adaptive practices to navigate effectively [20].

The International Council on Systems Engineering (INCOSE) describes the environment as Uncertain, Unpredictable, Risky, Variable and Evolving (UURVE) [21]. The environment can also be described as Volatile, Uncertain, Complex and Ambiguous (VUCA), a term borrowed from US military jargon in the 1990s [22]. The Scrum field book states that things are changing so rapidly that traditional ways of working are crumbling and complexity has become the norm [23]. This is in addition to the challenges posed by the Fourth Industrial Revolution and radical technical innovation [3].

Moreover, the evolution of technology and digital disruption have led to a profound impact on social and organizational systems, creating greater needs and customer satisfaction levels that force companies to improve their performance and competitiveness [24,25]. This reinforces the value of innovation in products and services, the optimization of operating processes and the development of a culture aimed at customer satisfaction in the digital era [26]. This highlights a management approach towards more dynamic, adaptable organizational change, which aligns with the concept of organizational agility [27].

The above has led to new principles and a different way of carrying out the strategy. This is known as the paradigm of agility, which adopts an open-system approach that establishes how an organization can function effectively in the current environment. This paradigm is characterized by formulating and executing the strategy with a dynamic and iterative approach, prioritizing skills, such as problem resolution, decision-making, adaptability, team self-management, feedback, collaboration and continuous learning [28,29].

These skills allow individuals and teams to navigate complicated and unpredictable situations, identify emerging opportunities, respond to changes quickly and continuously improve their performance [30]. In addition, effective communication and exchanges of information are crucial in an agile environment [31]. Organizations must promote a culture of transparency, trust and open communication to facilitate effective collaboration and decision-making [32].

SP can have a "hard" approach that emphasizes close integration between policies, systems and corporate processes with corporate strategy. For this reason, strategic management that is more adaptable to the constantly changing market is necessary [27]. Furthermore, organization must quickly create and take advantage of opportunities, personalize products for individual customers and be pioneers in technological advancement. This agility can be observed on two levels: systemic and local. Systemic agility is an organizational identity that is favorable for agility. From its shared beliefs and values, it tends to adapt to the evolving environment. Meanwhile, local agility refers to specific sub-units of an organization that need to be agile in different ways according to their functions and capacities [3].

3.1 Concepts and fundamentals of agility

Companies require a greater response capacity in light of an increasingly volatile business environment [33], which implies a more competitive market and assumes a higher probability of failure. In this way, companies need the agility to adapt their business models and strategically align with a constantly changing environment. This implies the capacity to quickly identify opportunities and make the necessary changes to organizational and operational processes to take advantage of said opportunities [34]. For example, the average lifetime of a company on the S&P 500 decreased from 33 to 24 years between 1964 and 2016, and this figure is forecasted to be 12 years by 2027 [35]. In fact, [35] estimate that half the companies on the S&P 500 would be replaced by 2028. The current rate of change is faster than ever, and the players that will lead the markets in the future are not even known today [36].

In any organizational environment, studies on strategy and organization indicate that strategy as a sequential, planned or imposed process from the top is an essential but not complete requirement to ensure compliance with decisions [37]. As a result, the concept of "agility" is receiving more attention, and the production of knowledge on this topic is increasing. Books, articles, academic literature and the professional press address agility and how it can help companies in light of impending change and external threats [33]. In this way, several IT and consulting vendors have shifted their efforts to providing agile transformation assistance. They provide a variety of organizational and technical solutions that help achieve a certain desired level of agility, in order to handle unexpected waves of change [33].

Despite the importance of agility, there is no consensus on its conceptualization or clarity as to how it could be evaluated or implemented in a company [33]. According to [36], agility is prone to error, partly because it has been carried over from its applications in software development, without clearly articulating the underlying assumptions and objectives. However, according to [5], agility was defined in organizational terms for the first time in 1982 as the ability to react quickly to rapidly changing circumstances [38]. The concept of organizational agility emerged as an approach to increase competitiveness in a context of economic stagnation in the U.S. manufacturing industry. Regardless of the industry, managers agree that organizational agility is central to achieving competitiveness in today's business environment [5].

The lack of conceptual clarity about agility is also widespread in applied organizational research, so it is common to find a significant number of definitions and disagreements [5]. The same is true for the concept of strategic agility, which is diffuse [39]. However, it is wrong to simply equate agility with speed and organizational change, because competitive advantages are achieved from a

variety of sources, such as reflection, slowness and active waiting. The latter variant is especially relevant for high-reliability industries that are not supposed to be agile in a transformational sense [36].

According to [40], agility refers to the ability to identify opportunities for innovation and seize them in the competitive marketplace by quickly and surprisingly assembling the necessary assets, knowledge and relationships. Agility involves both exploring and harnessing opportunities for market arbitrage. Exploration involves experimenting with new alternatives and seeking knowledge about unknown competitive opportunities. Exploitation involves using and developing what is already known, improving and expanding existing skills, technologies and knowledge. In addition, agility also encompasses a company's capacities with respect to customer interactions, the orchestration of internal operations and utilization of its external business partner ecosystem.

Overall, exploration activities enable these companies to adapt quickly to changes in external markets, which helps them be strategically agile. On the other hand, exploitation enables them to meet customer needs by continuously adapting existing products and services. The exploitation strategy enables companies to better understand how to more efficiently use current internal resources and capacities, which in turn allows them to be agile in reallocating resources to take advantage of new opportunities [41].

Thus, Organizational Agility refers to a set of business capacities to obtain favorable results in unpredictable and constantly changing environments [5]. It can also be defined as the ability to survive and thrive by reacting quickly and effectively in a competitive environment of continuous and unpredictable change, driven by customer-designed products and services [42,43].

On its part, the concept of strategic agility has a similar conception. It is defined as an organization's ability to rapidly change its strategic direction and reinvent its business model and/or practices in response to market changes, seeking to continue creating and delivering value to customers. Organizations require strategic agility if they are to maintain or gain competitive advantages and create value [44].

Strategic agility has been linked to organizations' creation and delivery of value. In highly competitive and volatile environments, strategically agile organizations can rapidly change their business models as they effectively adjust their product innovation processes to create and sell new products that address disruptions or specific market demands, reinventing and improving value creation through new production methods, products and services [45]. At the same time, in changing markets, strategic agility has been identified as contributing to more effective ways of delivering value, such as launching creative marketing campaigns and improving sales processes [44]. Some definitions of organizational agility or strategic agility are presented in Table 1.

According to [51], organizational agility is a broad concept that encompasses both operational agility and strategic agility. In other words, unlike other authors, it manages to differentiate one concept from the other.

Table 1.
Definitions of strategic agility and organizational agility

Source	Definition
[46]	The ability to cope with unexpected changes, survive unprecedented threats in the business environment and seize changes as opportunities.
[47]	An organization's capacity, through the proactive establishment of virtual manufacturing with an efficient product development system, to (i) meet changing market requirements, (ii) maximize the level of customer service and (iii) minimize the cost of goods, with the objective of being competitive in a global marketplace and seeking a greater likelihood of long-term survival and profit potential. Flexible people, processes and technologies must support this capacity.
[48]	Organizational agility is an enterprise-wide ability to cope with changes that often arise unexpectedly in business environments through rapid and innovative responses that exploit change as opportunities to grow and prosper.
[4]	An organization's capacity to efficiently and effectively redeploy/redirect its resources to value creating and protecting value and capturing higher return activities as warranted by internal and external circumstances.
[49]	The ability to survive and thrive in a competitive environment of continuous and unpredictable change by reacting quickly and efficiently in changing markets, driven by "customer-defined" products and services.
[50]	A company's capacity to survive and thrive in a competitive and unpredictable environment by responding quickly and effectively to any type of change—anticipated or unforeseen—in an appropriate and timely manner.

Source: Own elaboration based on literature review.

Specifically, organizational agility refers to an organization's ability to develop flexibility on both an operational and strategic level. Operational agility focuses on the flexibility of the organization's business processes. It implies processes' ability to gain speed, precision and cost savings in exploiting opportunities for innovation and competitive action. Finally, strategic agility focuses on the organization's ability to reformulate its offering and continually adjust its strategic direction.

[52] state that the most comprehensive definition in the literature explains that strategic agility is a meta-capacity that helps organizations anticipate, react and take advantage of rapid changes in the environment, redefining their corporate strategies and adapting their competitive and functional strategies to survive and create value. [52] also define strategic agility as a meta-capacity that involves both allocating sufficient resources to develop and deploy all specific capacities and remaining agile by balancing those capacities dynamically over time.

What these definitions have in common is that, in a complex and changing environment, companies need to be able to overcome the traditional organization's inertia and have the ability to incorporate continuous strategic changes into their operations [49]. To increase its agility, a company must orchestrate a variety of options, reflect on them and decide rather than allowing inertia and sunk costs to define its trajectory. From this perspective, agility is defined as the freedom and ability to accelerate decision-making [49]. An organization can only be agile from moment to moment and can only be agile to the extent that it practices agility. It is therefore not just a matter of using resources effectively or

developing new skills, or even being flexible, but of being able to respond to new situations through innovative methods and pragmatic and original solutions [53].

3.2 Dynamic capacities and agility

Conventional literature associates the concept of strategic agility with both dynamic capacities and ambidexterity (exploration and exploitation) [52]. The confused application of the concepts of agility and dynamic capacities reveals a critical discrepancy in these terms' definition and understanding [5]. Even in recent literature, the application of terms is imprecise and not uniform, which generates confusion among readers. This discrepancy is fatal to the operationalization and measurement of strategic agility in organizations. In addition, research results focused on specific aspects of agility can be very difficult to compile and process to form an overall picture of the company [5], leading to the possibility of understanding strategic agility from a holistic perspective.

According to [4], dynamic capacities are a company's ability to innovate, adapt to change and create favorable change for customers and unfavorable change for competitors. They considered dynamic capacities a collection of processes, routines, knowledge and entrepreneurial skills specific to management teams. This definition could be confused with those applied to strategic agility or organizational agility. However, [54] establish that dynamic capacities focus on reorganizing and transforming resources in order to innovate both in products and processes but are mainly related to adapting to external changes. They are strongly dependent on the uncertainty and volatility of the environment. However, they do not seek to promote continuous organizational change in stable market environments.

For [5], the dynamic capacities approach is useful in the context of agility, as it takes overall business capacities as part of dynamic capacities. This is fundamental to the harmonization of individual components and essential to the ability to anticipate developments and trends in a company's environment, which is an important characteristic of an agile organization.

[54] consider that Organizational Agility (OA) is a dynamic capacity with two dimensions: an offensive and a defensive one. An organization can only operate in an agile and successful manner if both crucial dimensions of dynamic capacity are well-developed. Based on this, these authors conceptualized OA as a higher-order dynamic capacity that allows configuring and reconfiguring organizational resources in response to the environment or emerging competitive realities. Integrating lower-order functional capacities facilitates developing new higher-order dynamic capacities, which in turn enables carrying out innovative competitive actions [55]. In short, organizations with high OA, and therefore strong higher-order dynamic capacities, can detect opportunities and threats, assemble the assets and capacities needed to carry out an appropriate response, assess the benefits and risks of initiating action, and execute actions with speed and competitive success [55].

[54], define strategic agility as a company's ability to constantly renew itself and maintain its flexibility without compromising its efficiency. However, they state that, unlike dynamic capacities that respond to external changes, strategic agility focuses on systematically implementing these dynamic capacities to make continuous adaptations within the company's structure of products, processes and services, but without necessarily being motivated by alterations in the environment.

In this way, strategic agility differs from dynamic capacities in that it allows companies greater flexibility in their organizational structure, in order to gain advantages as part of their strategic plan without necessarily being driven by external changes. Strategic agility helps companies make rapid changes, preserving their momentum and renewal capacities, without necessarily depending on changes in the environment. This clearly distinguishes it from dynamic capacities, which are more aimed at responding to external changes [54].

3.3 Meta-capacities and strategic agility

With respect to strategic agility capacities, [44] suggest that strategic agility, in order to anticipate developments, perceive opportunities and create value through innovation, is made possible with three specific capacities:

The first is defined as customer agility and refers to an organization's ability to closely interact and co-create with customers [44]. It refers to customers' participation in searching for opportunities for innovation and competition. Customers play an important role in providing innovative ideas, collaborating in the development of new products and services, and testing and disseminating information about them. Customer agility means companies must leverage customer feedback to gain market intelligence and identify opportunities for competitive action [40].

The second is defined as partnership agility and consists of the ability to exploit the resources and skills of partners [44]. Leveraging the resources and expertise of suppliers, distributors, contract manufacturers, and logistics partners through strategic alliances, partnerships, and joint ventures [40]. This allows companies to build a collaborative network to explore opportunities for innovation and competition. It also involves the ability to take advantage of opportunities through the efficient management of manufacturing, logistics and customer support resources and assets. Companies can adapt and adjust their network of business partners when they need access to resources and knowledge that are not available internally [40].

Finally, operational agility refers to an organization's ability to reconfigure resources to create new processes that take advantage of emerging opportunities [44]. It refers to the ability of companies' business processes to be fast, accurate and cost-effective in exploiting opportunities for innovation and competition [40]. Operational agility enables companies to redesign and create new processes to adapt to changing market conditions. Information technologies play an important role in enabling the automation of business processes, which in turn facilitates creating new processes by combining and reconfiguring components [40].

Other capacities are also mentioned, defined as "meta-capacities," which are the conjugation of strategic sensitivity, leadership unity and resource fluidity in a company

[19,37,52]. Strategic sensitivity refers to a capacity for proactive vigilance [52], relates to the degree of alertness around the exploration and exploitation of opportunities [37], and implies the company's ability to detect opportunities, identify market needs and assess its own strengths and limitations [41]. According to [41], companies can constantly reinvent their value propositions through this strategic sensitivity, adapting to changing market demands. This implies a highly participative internal dialogue [52].

Unity in leadership refers to the management team's collaboration and commitment to adapt to changes in the environment [41]. This commitment is crucial to the feasibility of new value propositions and to making timely decisions that drive structural and operational changes necessary for value creation. This capacity is derived from a collaborative and mutually dependent team with an integrative leadership style [52].

Finally, resource fluidity refers to the ability to reconfigure and reallocate resources and capacities according to the new strategies established by the company, i.e. the ability to realign the structure with the business strategy [39]. The ability to allocate and redistribute resources allows for greater flexibility in reorganizing and adapting to new market demands, making it possible to reconfigure resources and revise the cost and revenue structure to reflect strategic changes [41]. These dimensions intertwine to drive the ability to adapt and change business models in a constantly evolving business environment [41].

[40] claim there are many more meta-capacities, among which competitive intelligence, strategic flexibility and organizational innovation stand out. Strategic flexibility is defined as a company's ability to manage both unpredictable threats and available opportunities in an uncertain and unstable environment by combining flexibility with aspects of stability [40]. This implies the ability to make the internal changes necessary to respond effectively to the external environment, while maintaining the survivability of its products, services and brands, turning every obstacle into a new opportunity.

Organizational innovation refers to the process by which an organization acquires, shares and integrates knowledge in order to create new knowledge about products and services [40]. This involves developing or adopting new ideas or actions in business practices within organizations, as well as introducing new products and services, improving existing ones and modifying the way a company is organized, creating new, more agile, creative and productive models.

Lastly, according to [40] competitive intelligence is the process of gathering and analyzing information to identify the strengths and weaknesses of competitors. It helps managers make rational, evidence-based decisions, rather than relying on experience and instinct. It uses technology, such as software and business analytics, to accurately collect data and analyze the environment. It is a dynamic process that collects, analyzes and shares data, information and knowledge within the organization, thereby improving strategic decision-making.

With that in mind, strategic agility originates from the coherent and consistent actions and skills of senior management, rather than from a structure or duality. It can be understood as the result of a combination of forces derived from the actions and skills of the individual managers involved in the collective action, which are ultimately grouped into the described meta-capacities [19]. Everything presented until now suggests that agility is not a stand-alone skill, but rather a characteristic resulting from a set of skills that integrate adaptability, speed, innovation, sustainability and organizational resilience [39]. Ultimately, if managers want to successfully develop organizational agility, they must be able to identify and influence all of the meta-capacities that are considered important [40].

3.4 Agility and organizational culture

Unleashing the forces that promote strategic agility places significant demands on leadership, even as contributions are divided and distributed among senior executives, since natural evolution leads to greater strategic rigidity as a company ages. In order to promote strategic agility, senior executives must abandon old habits and acquire new skills, practices and behaviors [19], which involves and affects the organization's culture.

Organizational culture can be described as the set of shared values and beliefs that enable people to understand how the organization works and provide them with guidelines for behavior within the organization. This culture is related to the fundamental values shared by the organization's members and involves various aspects that help understand why organizations and their members act in a specific way [56].

A company's ability to demonstrate strategic agility largely depends on how agile its teams are [37]. However, the fact that a team works under agile frameworks is not synonymous with the fact that the company's organizational culture is itself agile. Organizational agility is achieved through a culture of adhocracy that is intrinsically strategic to the organization. Agility must be rooted in a company's culture, where different types of organizational culture, such as clan, adhocracy, market and hierarchy, are balanced [40].

According to [56], it is difficult to deal with and manage a culture that is right for everyone. People in different departments cluster around their own interpretations of the company's main culture, creating organizational subcultures, which develop specific values and standards that may differ from those of the organization's main culture. This is especially true in project teams, in which team members may develop their way of managing organizational interactions based on methodology, objectives and circumstances.

Strategic agility is achieved when many individuals share similar behaviors, beliefs and values [19]. In other words, it is not a partial practice executed by a particular group. Achieving overall strategic responsiveness requires a high degree of organizational learning, as it allows for increased internal knowledge, which is essential for developing strategic agility. A learning organization is one that integrates people and structure to drive continuous learning and change [57]. This is vital because strategic agility requires continuous reflective attention, commitment to self-learning, that of others, and conscious discipline in management [19].

Training is a key resource that impacts organizational success, and the ability to learn from past mistakes is crucial

for innovation and growth. In addition, a strong learning culture is essential for developing appropriate skills and competencies for employees, which in turn drives change and continuous improvement in the organization [57]. After all, these executives or employees are the ones who lead activities, such as creating strategic partnerships, developing new products, hiring new talent, and other responsibilities [37].

According to [51], technological, relational and innovative capacities positively influence the organizational agility of companies, which in turn has a favorable impact on their financial performance and product and process innovation. It is important to develop these capacities to improve business agility and performance, which can be crucial in challenging environments. In addition, they underline the relevance of digital transformation, and the adoption of a new organizational attitude focused on applying digital technologies.

Following, [57], digitization is a crucial and significant factor in a company' strategic agility. Information and communication technologies also play an important role in advancing agility and have a positive impact on business performance. In the context of digitization and digital transformation, it is essential for members of organizations, such as members of the innovation team, to have relevant digital and agile skills.

Finally, according to [19] it is difficult to maintain strategic sensitivity in an environment that values predictability and steady growth in earnings. In addition, success can diminish strategic sensitivity, as individuals become accustomed to solving problems and replicating past successes rather than challenging themselves. Experience in executive roles does not always prepare leaders to be strategically agile, as they are often focused on operational performance and excellence. In this sense, it is important to develop an agile and strategic mindset to face daily challenges and expand the intellectual and emotional limits of leaders.

4 Conclusion

Strategic management is critical to business growth and survival in an ever-changing environment. Traditional strategic planning has been losing its value due to uncertainty in the market, which has generated the need for a more dynamic approach known as strategic agility. The agility approach seeks to generate business adaptation and sustainability in competitive environments and has been identified as a managerial quality of organizations that continuously seek to evaluate their products and processes, using flexibility and dynamic capacities.

This article explains the main differences between traditional strategic planning and strategic agility, which can help professionals make more informed decisions about how to approach strategic management in their organizations. The research also highlights the value of the agile approach to strategic management in dynamic and changing environments.

Strategic planning (SP) and organizational agility (OA) have a fundamental focus on seeking precise and timely answers based on data, which highlights an intrinsic need to adapt to a constantly evolving business environment. However, while SP has historically been organized around hierarchies and strict procedures, OA emerges as a more versatile model that fosters internal relationships at a horizontal and collaborative level.

This horizontality in OA enables greater adaptability and agility in decision-making, promoting innovation and responsiveness to market opportunities. Both approaches, despite being distinct in their structure and methodology, aim to preserve competitiveness in an environment where the ability to adapt has become essential. Therefore, incorporating agile components into strategic planning can enhance the organization's ability to not only survive but thrive in an increasingly complex and fluctuating business environment.

Finally, the article discusses the need for future research, examining how companies have implemented agile practices in strategic management and how they have been able to adapt to market changes and take advantage of emerging opportunities. These case studies and specific empirical data could provide valuable information on best practices and common challenges in implementing agility, which could help companies make decisions on how to approach strategic management in their organizations.

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The challenges and opportunities for ethics in generative artificial intelligence in the digital age

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Abstract
Generative Artificial Intelligence (GenAI) emerged as a prominent tool in early 2023, renowned for its capability to generate unique texts and images from minimal input. Despite its growing popularity, the ethical implications of this technology remain under-explored. This study aimed to examine the ethical dimensions of GenAI, particularly focusing on the guidelines necessary during the lifecycle of the algorithms that drive it. We employed a qualitative, non-experimental, descriptive, and exploratory methodology. A comprehensive bibliometric analysis encompassed one hundred and fifty bibliographic references. The analysis highlighted significant concerns regarding algorithmic discrimination, justice, data privacy, and the inherent risks associated with this nascent technology. The findings reveal a pressing need for robust protocols to govern the development of GenAI applications to mitigate risks such as algorithmic bias and privacy breaches. Without such frameworks, the broader social and economic impacts of GenAI pose substantial challenges. This paper concludes by discussing the profound ethical implications of digital platforms driven by Generative Artificial Intelligence.

Keywords: project management; generative artificial intelligence; algorithmic discrimination; ethical implications; algorithmic justice.

Retos y oportunidades de la ética en la inteligencia artificial generativa en la era digital

Resumen
La Inteligencia Artificial Generativa (GenAI) surgió como una herramienta destacada a principios de 2023, famosa por su capacidad para generar textos e imágenes únicos a partir de entradas mínimas. A pesar de su creciente popularidad, las implicaciones éticas de esta tecnología siguen siendo poco exploradas. Este estudio pretende examinar las dimensiones éticas de la GenAI, centrándose especialmente en las directrices necesarias durante el ciclo de vida de los algoritmos que la impulsan. Se empleó una metodología cualitativa, no experimental, descriptiva y exploratoria. Se llevó a cabo un análisis bibliométrico exhaustivo que abarcó ciento cincuenta referencias bibliográficas. El análisis puso de manifiesto preocupaciones significativas en relación con la discriminación algorítmica, la justicia, la privacidad de los datos y los riesgos inherentes asociados a esta tecnología naciente. Los resultados revelan una necesidad acuciante de protocolos sólidos que rijan el desarrollo de aplicaciones GenAI para mitigar riesgos como el sesgo algorítmico y las violaciones de la privacidad. En ausencia de tales marcos, los impactos sociales y económicos más amplios de GenAI plantean desafíos sustanciales. Este documento concluye debatiendo las profundas implicaciones éticas de las plataformas digitales impulsadas por la Inteligencia Artificial Generativa.

Palabras clave: gestión de proyectos; inteligencia artificial generativa; discriminación algorítmica; implicaciones éticas; justicia algorítmica.

1 Introduction

In a world where Artificial Intelligence (AI) has made significant advancements in diverse fields such as medicine, customer service, and government decision-making, it has also empowered an even more promising domain: Generative Artificial Intelligence (GenAI). This article delves into this vibrant area, aiming to explore its rapid growth and the complex ethical implications that evolve alongside it.

While AI has demonstrated its ability to enhance productivity and efficiency across various industries, the ethical dimensions have increasingly come to the forefront,

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as shown in prior research. Algorithmic discrimination has been observed in personnel selection systems, credit algorithms, and criminal justice systems. Moreover, data privacy concerns have escalated due to the improper collection and processing of personal information. Additionally, issues related to transparency and accountability have emerged concerning the autonomous decisions made by these systems.

Despite growing awareness of these ethical challenges, a significant gap remains between conceptual design and practical solutions implementation. This leads to a pivotal question addressed in this research: How can we effectively conceptualize, design, implement, and enforce ethical guidelines in the algorithms that power GenAI?

To address this question, the study undertook a bibliometric review of one hundred and fifty research articles focused on ethics in GenAI. The findings highlight the prevalence of algorithmic discrimination and ethical biases, underscoring the necessity to integrate ethical considerations throughout the lifecycle of mathematical algorithms.

Imagine a scenario where an AI-driven decision determines your professional or financial future. In today's environment, where AI is reshaping sectors from healthcare to public administration, GenAI emerges as a particularly challenging field. This analysis explores the swift expansion and the ethical complexities that accompany it. Addressing these ethical dilemmas has become increasingly vital, highlighted by global instances of algorithmic discrimination and privacy violations.

This document aims to dissect the fundamental ethical challenges associated with GenAI, providing a detailed and nuanced examination of its broader implications. It seeks to bridge the gap between ethical theory and practical application, posing an essential question: How can we ensure that the transition from theoretical concepts to practical ethical norms in AI promotes a fair and just future?

Through a comprehensive bibliometric review of one hundred and fifty studies, this work not only underscores the widespread issues of bias and algorithmic discrimination but also emphasizes the critical need to incorporate ethical considerations throughout the entire algorithmic lifecycle. We propose a detailed strategy for embedding ethical practices from the initial design to the final implementation of these systems.

The objective of this article is to make a substantial contribution to both academic and professional dialogues, establishing a robust framework for ethical practices in artificial intelligence. It will explore theoretical foundations, analyze relevant case studies, and provide actionable recommendations. This approach aims to clarify the direction of the analysis and enhance the understanding and application of its conclusions.

Moving forward, it is crucial to ensure that the discourse remains accessible and free from unnecessary jargon, enabling a broad audience to comprehend and engage with the topic. The significance of this research lies in its potential to illuminate current and future ethical challenges in artificial intelligence, thus paving the way for responsible and ethically aware innovation.

2 Literature review

By exploring the historical evolution of ethics in AI, it is possible to understand how concerns in the development and perception over time, mark significant milestones in their intersection [1]. In its early years, between 1950 and 1960, discussions were limited, as the focus was on the technical aspects and potential of this technology. However, as systems became more sophisticated (1970s - 1980s), it enabled autonomous decision-making, and concerns about accountability and transparency emerged, the main emphasis being how machines handled ethical issues [2].

Thus, in 1990, the first codes for AI research were created. This marked a more significant moral awareness in the design of algorithms and systems, with privacy as a central concern. With the massification of the Internet and big data analytics, the discussions focused on the protection of personal information and its respective use [3]. Since 2010, algorithmic discrimination stood out as a significant ethical concern, as cases arose in systems that perpetuated segregation in areas such as criminal justice and access to financial credit. This led to using technology with a renewed focus, based on equity and algorithmic justice. This, in turn, has triggered a debate in different sectors, concerning the ethical responsibility of GenAI in society [4].

As a result of this evolution, accountability frameworks and transparency mechanisms are being developed to address emerging challenges. History shows how concerns have evolved in the ever-changing technology world [5].

The role of ethics in AI is its responsible application to the development of computer systems life cycle, which requires a full understanding of some key aspects, to ensure their proper use [6].

Pérez-Ragone [7] study establishes the concept of algorithmic justice as the need to ensure that mathematical models do not perpetuate or amplify prejudices or discrimination in their results, an important aspect to consider when designing impartial and equitable systems, thereby avoiding discrimination. Niebla-Zatarain and García-Feregrino [8] highlight the role of privacy, which includes ensuring adequate procedures in the collection, use, and disposal in an ethical, legal, and responsible manner. Besides, these measures must include the implementation of appropriate measures to ensure their protection.

It added to the above transparency, as it outlines the ability to understand computer systems and decision-making, facilitating access to information and personal data, being a fundamental pillar for its development over time [9]. Terrones-Rodríguez [10] raises the role of reality, as it involves determining who is responsible when computer systems make mistakes or cause damage. This implies the assignment of roles and responsibilities among developers, operators, and users, along with the ability to be accountable for harmful algorithmic decisions, to ensure a timely response.

Therefore, ethics in AI seeks to apply moral principles to technology to ensure that its development and use are socially responsible, as the design and application in computer systems are the gateways to address the concepts of algorithmic justice, privacy, and transparency [11].

The impact of AI encompasses multiple dimensions. Labor automation has emerged as one of the most notable aspects, revolutionizing how companies perform repetitive and redundant tasks, and enhancing operational efficiency. However, it raises concerns about job losses and the need for labor transition to new fields of work [12]. Also, autonomous decision-making has played a role in resolving crucial issues, from medical diagnoses to urban traffic management. However, it has generated debate about the transparency of decisions and the assignment of responsibility in case of errors [13].

Security (data privacy) is a primary concern due to the central role they play in the operation of this technology. Despite extracting valuable information from the data, it has channeled a series of questions toward the protection of vulnerabilities [14]. Therefore, fairness and algorithmic biases represent significant challenges in this field, as computer systems can inherit biases in training data, leading to discriminatory decisions, highlighting a pressing need to ensure fairness and algorithmic justice in its development [15].

Education has undergone significant transformations with the popularization of online courses, virtual tutoring systems, and adaptive and generative learning tools, such as ChatGPT. These innovations have expanded access to education, but they continue to pose challenges related to the quality of online education and equal access opportunities [16]. Technology raises broader ethical and social responsibility issues. Developers and regulators face the challenge of ensuring ethical and responsible use for the benefit of society, understanding that this is essential to addressing such challenges [17].

Algorithmic discrimination is a topic that deserves closer examination, as its implications significantly affect diverse groups of people. A deeper examination reveals specific cases where AI systems have demonstrated the ability to perpetuate entrenched societal biases and discrimination. These are abstract and translate into tangible impacts on the daily lives of individuals and entire communities [18].

A concrete example can be seen in personnel selection processes. When algorithms are trained with historical data that reflect gender or racial biases in hiring decisions, they learn to replicate and perpetuate such biases, resulting in unfair discrimination against candidates from certain groups, which undermines employment equity and diversity in the workplace [19]. In the field of criminal justice, algorithmic discrimination also manifests itself. For example, probation or sentencing can show biases based on historical data, denoting unequal treatment for different ethnic or social groups. This leads to devastating consequences for those affected by these decisions, as well as the perception of justice in society [16].

Addressing these problems requires a thorough understanding of how biases develop in mathematical algorithms. Hence, it is indispensable to mitigate and eliminate them effectively, occasioning a detailed examination of training data, application of correction techniques, and promotion of policies that foster fairness and algorithmic justice, along with a constant commitment to continuous improvement and accountability, ensuring that computer systems are fair and equitable for all members of society [20].

Tucker [21] highlights that data privacy leaves an unresolved concern about the procedures of collection, use, and disposition, which is an issue of great concern in today's society, particularly with the widespread GenAI through platforms, becoming an unresolved concern at the time of this study, based on the protection of the privacy rights of individuals when using AI in everyday life.

The collection of massive data has become a common practice in the digital era, where different disruptive technologies allow feeding the mathematical algorithms for processing in an accelerated way. This becomes an industrial maquila, where the criteria for information security are relegated to the background. This is a shared feeling among users, since their data may be at risk due to the lack of a procedure, standard, or legislation to ensure that it is not shared without their consent [22]. In addition, online data collection, as with GenAI, through interactions in social networks, Internet browsing, and financial transactions, has raised concerns about the exposure of user information [23].

Therefore, it is essential to implement effective regulations, encourage responsible data collection and storage protocols, use international best practices, including consent policies and security measures, and focus on the privacy of individuals as a fundamental principle in the design of AI-based solutions. This must be done in conjunction with the promotion of education and public awareness of the importance of data privacy [24].

When analyzing the ethical implications, AI autonomous decision-making highlights crucial issues that influence society [25]. Independent decision-making has the potential to affect people’s lives profoundly and significantly. For example, in health care, it can be used to identify diseases, choose treatments, or predict a patient's diagnosis, and these decisions can have a direct impact on people's health and well-being, which requires meticulous ethical consideration [26].

Furthermore, allocating resources, such as distributing funds for health care or granting loans, is often based on automated decisions supported by mathematical algorithms, thus affecting equity, and accountability [17]. Autonomous decision-making must guarantee transparency since the development and implementation of these algorithms are complex processes as they are based on data processing rather than on people's understanding. Therefore, it is necessary to propose a method that guarantees that decisions are transparent and easy to transmit [27].

Consequences in autonomous decision-making require a balance between efficiency and ethics. This involves not only ensuring that arrangements are fair and beneficial to people, but also considering how ethical values can be programmed into systems, and how accountability can be established in the event of detrimental decisions. The intersection of ethics and technology is a critical area, demanding deep reflection and a practical regulatory framework, to guide development and implementation ethically and responsibly [28].

The exploration of codes of ethics and guidelines reveals a diverse panorama of efforts aimed at promoting the responsible use of this technology in society [29]. For example, with the European Union (EU) guidelines, critical

orientations are raised in the High-Level Expert Group (HLEG) report, where fundamental principles, such as the application of the requirement of logic, are highlighted so that AI can explain its decisions clearly, ensuring informed decision-making [30].

The Association for Artificial Intelligence (AAI) emphasizes using this technology to benefit humanity. This is applicable in various areas, including autonomous vehicle systems, where the need to comply with traffic regulations that ensure public safety is stressed [31]. Google AI ethical guidelines published for the development of AI state their commitment to fairness and reduction of algorithmic bias. In practice, this is reflected in the continuous improvement of content recommendation systems, avoiding the promotion of harmful or misleading information, which is essential for maintaining the trust of users and the integrity of the platform [32].

The United Nations for Education, Sciences, and Culture (UNESCO) AI principles propose a global orientation for its use, highlighting gender equality and cultural diversity as customer service chatbots. These translate into efforts to avoid the creation or perpetuation of gender stereotypes, promoting equity, and respect for diversity [33]. As previously expressed, this illustrates how codes of ethics and guidelines in the field of AI are not mere abstract statements but have a concrete impact in various areas and applications.

Ethics in algorithm research and development needs to ensure the responsibly and to benefit the common good [34]. Therefore, exploring integrity, which spans data collection and presentation, requires intellectual honesty to preserve the necessary trust in the short-, medium--, and long-term fields [35].

To this end, biases in the inquiry processes become a fundamental element. This may arise in selecting data, formulating research questions, and interpreting results [36]. Then, transparency and reproducibility emerge. The first is the relationship between methods and results, which is a fundamental principle in ethics. This includes providing access to data, source code, and details of experimental procedures to reproduce the results, which contributes to building trust and ensuring verifiability in AI [37].

Likewise, ethics in data collection for AI model training involves privacy considerations and informed consent, and anonymity must be guaranteed when necessary [38]. Now, in the development process, designers must incorporate ethical considerations from the beginning to ensure the principles of fairness, transparency, and accountability [39]. Therefore, before implementing applications in society, it is essential to carry out an ethical impact assessment, which involves analyzing how AI may affect different segments of the population, biases, and how users' privacy will be protected.

In the year 2022, AI attracted significant attention and admiration with the emergence of GenAI through ChatGPT technology, with debates focused on its advantages, ethical aspects, drawbacks, and limitations. This discussion involved various stakeholders, such as academics, politicians, mass media, experts and non-experts in the area, and global business leaders [40].

ChatGPT is nothing more than a Large Linguistic Model (LLM) based on pre-trained transformers, hence the origin of its name (Generative Pre-trained Transformer (GPT)). This application has achieved extraordinary performance in tasks associated with natural language processing [41]. The model has the capacity, with over 175 billion parameters, which has allowed it to deal with a variety of thematic and generate congruent, coherent, and informative answers [42].

Currently, ChatGPT is the most popular application to generate conversations with the capacity to integrate into Chatbots. These chatbots provide various queries from a company's users or customers, allowing organizations to automate their organizational processes and optimize the production factors of goods and services, along with real-time resolution of complex problems and improvement of customer experience, thus achieving a competitive advantage as part of the digital strategy [43].

Another application of ChatGPT is the generation of high-quality, consistent, and focused content on a particular topic. This is helpful for companies seeking the creation of topics, philosophical endeavors, or creation of tasks in an automated fashion [44]. Additionally, the model allows for text classification to be matched with pre-labeled data that allows for accurate classification of different classes or segments of data. This, in turn, enables monitoring, analysis, and understanding of the opinions and trends of the public, being useful for areas [45].

This GenAI model is undoubtedly a fantastic technology for increasing corporate productivity, as it has a wide variety of technology solutions, and certainly goes beyond text editing or note-taking.

Although ChatGPT is GenAI LLMs, e.g.: Jasper, Google's Apprentice Bard, Replika, Meta's OPT (Open Pretrained Transformer), Palm, Bloom, Character.ai (forthcoming), Chinchilla, Chatsonic, ELSA Speak, Sparrow, Megatron, DialoGPT, Perplexity, and Playground [46]. All these applications take as a principle the use of ML, to achieve the understanding of behavioral patterns of the data obtained in real-time, and to produce information as accurate as possible to what the user expects [47].

However, not everything is as it seems, since like other disruptive technologies, ChatGPT has its dark side; this is mainly inherited from philosophical aspects and discussions in society about the interference and impact of AI in the development of the business sector, one of the relevant issues being the possible ethical biases of the technology [48, 49].

The challenge of ChatGPT, like any AI technology based on virtual assistants (chatbots), is that it cannot be used as an authoritative source of information because the contents and data are not necessarily obtained from reliable Internet sources. This creates misinformation, which can be used by individuals or companies for commercial or malicious purposes [50]. Consequently, dependence on data is a drawback, since there is no criterion to validate whether the information is accurate or authentic, not to mention that if the data is scarce or nonexistent, it cannot respond [51].

Similarly, ChatGPT is a recent technology that is still in the process of development and evolution. It has been

criticized for its ambiguities and inaccuracies as it produces texts that seem plausible and convincing but contain errors or lack meaning, causing what is known in LLMs as "hallucination." In addition, there are no references or citations to obtain information, so it is not ideal to use this chatbot alone for research or electronic tracking [52].

GenAI-generated LLMs can also give rise to abuses due to how they use Internet information. A biased or discriminatory response could upset some people, requiring careful review of all content [53]. Therefore, many organizations, schools, and countries have banned it since they are concerned about copyright infringement and privacy laws, along with the possible replacement of services currently provided by humans, such as customer service, where the lack of advice may raise ethical issues for the company.

As GenAI continues to make headlines, we must be careful about the technology we adopt. In the coming years, investment priorities will shift so that ethics, privacy, and compliance teams will rely even more heavily on security teams to ensure their privacy controls comply with new regulations. GenAI may or may not fit into this plan. In either case, analysts must weigh the pros and cons of the interface and determine whether it is genuinely worth the integration risk.

3 Research methodology

In the context of this study, a methodology that amalgamates a narrative and critical literature review with an exploratory and descriptive qualitative approach was implemented. The objective was a detailed analysis of the ethical aspects of GenAI, focusing on the guidelines to be followed during the life cycle of the mathematical algorithms that constitute it.

As a starting point, a narrative and critical review of previously existing literature in the field of ethics in GenAI was carried out, to elaborate a solid conceptual framework based on previous research [54]. The methodology was supported by a deductive line of reasoning to structure the proposal of this study logically and productively. Consequently, it allowed a deep dive into the ethical aspects of GenAI and the emerging trends in this field, focusing on the coexistence and evolution of ethics and technology, based on the approaches cited [55].

For this purpose, a bibliometric review of scientific articles between the period of 2017 to 2023 was conducted, and from here one hundred and fifty bibliographic references related to the topic of the study were selected. The selection of these sources was based on the expert judgment of the researchers, who evaluated the relevance of the articles to the current research.

Subsequently, the documentary review was conducted through searches in electronic databases, such as Web of Science, Emerald, Scopus, Science Direct, and EBSCO host, and consultation of websites of recognized authors in the field. These were carried out in Spanish and English, using specific search criteria, incorporating keywords such as "generative artificial intelligence," "GenAI," and "ethics."

Table 1.
Matrix of contrasting findings.

Database	Search Criteria
Web of Science, Emerald, Scopus, Science Direct, EBSCO host and Internet Sites in English	"Generative artificial intelligence" + "GenAI" + "Ethics" + "articles only"
Web of Science, Emerald, Scopus, Science Direct, EBSCO host and Internet Sites in Spanish	"Inteligencia artificial generativa" +" GenAI" + "ética" + "solo artículos"

Source: Own elaboration.

Once the sources had been compiled, a contrast matrix was constructed to record the sources identified according to the databases (see Table 1). Subsequently, the data were centralized, identifying relevant descriptors such as impact, discrimination, data, privacy, and decisions.

Upon compiling all relevant information, the identification, triangulation, and inferring of the characteristics and factors that define the ethical phenomenon in Generative Artificial Intelligence (GenAI) were carried out. Additionally, an attempt was made to discern the evolutionary trends of ethics in AI, recognizing them as challenges and opportunities in the digital era.

This methodology facilitated the examination of the prevailing controversies, pivotal discussions, and potential threats associated with GenAI. This analysis is strengthened by the contributions of prominent researchers such as Cooper [41], Murugesan and Cherukuri [42], Chintalapati and Pandey [56], Zemankova [57], Budhwar, et al. [58]. These scholars have underscored the growth and diversification of ethical approaches within the field of GenAI, highlighting its dynamic and evolving nature.

4 Results

The term "artificial intelligence" appeared in 95% of the searches conducted. However, when combined with "ethics," this figure decreased to 75% of the results. Conversely, when the terms "generative artificial intelligence" and "GenAI" were paired with "ethics," the results consistently remained at 75%. This consistency underscores the relevance of these terms in scholarly research concerning the ethics of generative artificial intelligence. Additionally, key descriptors such as "impact," "discrimination," "data," "privacy," and "decisions" were frequently encountered. This indicates a state-of-the-art approach to exploring AI ethics that is both comprehensive and multidisciplinary. Table 2 displays the findings categorized by the publication year of articles addressing GenAI and ethics.

Table 2.
Results of the search for the object of study.

Year	Items	Percentage
2017	10	0.37%
2018	14	0.52%
2019	18	0.66%
2020	28	1.03%
2021	55	2.03%
2022	138	5.09%
2023	2450	90.31%

Source: Own elaboration.

Table 3.
Scientific studies identified.

Type of study	Items	Percentage
Literature review	68	45.59%
Case studies	54	36.15%
Empirical	27	18.26%

Source: Own elaboration.

Table 4.
Relevant findings in the literature review.

Topic	Number of matches	Percentage
Data privacy	220	24.58%
Discrimination	160	17.88%
Risk	140	15.64%
Decision making	120	13.41%
Impact on the common good	90	10.06%
Potential biases	98	10.95%
Rights and values	67	7.49%

Source: Own elaboration.

Table 5.
Relevant findings in empirical studies.

Topic	Number of matches	Percentage
Exposure	230	31.59%
Veracity of the data	160	21.98%
Accuracy	123	16.90%
Legal implications	110	15.11%
Governance	105	14.42%

Source: Own elaboration.

As illustrated in Table 2, the focus of the study on the ethical implications of generative artificial intelligence (GenAI) gained significant traction in 2023, accounting for 90.31% of the relevant literature. This surge in interest was primarily fueled by the commercial success of ChatGPT, developed by OpenAI [40,43,52,59-61]. During our detailed review, guided by the expert judgment of our researchers, only scientific studies from 2023 were selected. This decision was based on the contemporaneity and pertinence of the guidelines, as well as the direct linkage between the design and application stages of mathematical algorithms in GenAI and ethics. Consequently, the pool of studies was narrowed to one hundred and fifty.

It is noteworthy that before 2023, no unified reference framework for conducting these studies existed, leading each study to devise its methodological approach, drawing on prior knowledge, experience, and expertise. However, the emergence of the ChatGPT application provided a clear roadmap for subsequent studies, serving as an additional criterion for our selection process. Table 3 presents a summary of the selected studies, illustrating the standard methods for identifying patterns and emerging trends in the application of ethics within GenAI.

Table 3 shows that three significant categories have taken off during 2023, whose details are analyzed as follows:

1 This category is the most representative in the sample. Upon reviewing in detail, the contents of the studies, by counting words and phrases, the following became evident (see Table 4):

The analysis underscores that the foremost concern among the studies, with 24.58% focus, is the protection of data privacy on Generative Artificial Intelligence (GenAI) platforms. Following closely, with 17.88%, is an examination of the methods used to encode mathematical algorithms and their influence on business decision-making processes, which itself ranks fourth with a focus of 13.41%. The third most prevalent issue is the risks associated with the adoption of this emergent technology and its potential impacts on business continuity. Conversely, issues concerning the common good, potential biases, and the rights and values impacted by GenAI received comparatively less attention in the studies reviewed.

Given that GenAI only surged in popularity in 2023, both the academic and business sectors are still in the early stages of comprehending and integrating these technologies. This nascent familiarity could explain the low emphasis on these broader societal issues in the selected studies.

Lindebaum, Vesa and Den-Hond [28], Marjanovic, Cecez-Kecmanovic and Vidgen [62], point out a significant gap: the absence of comprehensive frameworks within GenAI platforms. Such frameworks are critical for developing a clear roadmap that guides the ethical use of technology throughout the lifecycle of mathematical algorithms, with a particular focus on addressing discrimination, ensuring algorithmic fairness, and mitigating ethical biases.

2. Empirical studies (54 studies, 36.15%): This category suggests the generation of field studies to collect more data and empirical evidence to demonstrate the impact of GenAI and ethics as a phenomenon in modern society. Table 5 presents the findings obtained in this category.

In the empirical studies, the level of exposure (31.59%) and the veracity (21.98%) of the data when using GenAI technology stand out. Then, on a second level of importance, accuracy (16.90%), legal implications (15.11%), and governance (14.42%) stand out. Consequently, the results suggest that at the time of the study, the trend in science sought to understand the capabilities and benefits that GenAI could offer, leaving the regulatory and management aspects behind, with the lowest level of interest to be addressed in scientific research.

Murugesan and Cherukuri [42], Langevin, et al. [63], Mannuru, et al. [64] identified GenAI's ability to create unrealistic and unstable data structures, requiring the creation of specific designs to correct these flaws, an area that requires a better definition for its use. When using productive AI to document the following procedures, it is a primordial aspect.

3. Case studies (27 studies, 18.26%): In third place is the comprehensive understanding of uses, applications, experiences, and lessons learned in the field surrounding GenAI and ethics. These have been documented for academic and scientific purposes (see Table 6).

Table 6.
Relevant findings in the case studies

Topic	Number of matches	Percentage
Social implications	95	19.19%
Legal aspects	65	13.13%
A good outcome	70	14.14%
Privacy	88	17.78%
Intellectual property rights	65	13.13%
Potential biases	*55*	11.11%
Content	*57*	11.52%

Source: Own elaboration.

The findings from the study are categorized into three main groups: 1) Social implications (19.19%) and data privacy (17.78%), reflecting studies that examine the trends and impacts of technology on society, yet often overlook the ethical repercussions; 2) Positive outcomes (14.14%), legal aspects (13.13%), and intellectual property rights (13.13%), which underscore the impact and legal consequences of GenAI usage, affecting companies, individuals, and society at large; and 3) Content management (11.52%) and potential biases (11.11%), focusing on the ethical implications of mathematical models in content management and the potential for bias in decision-making, highlighting research that documents these issues at an early stage.

Researchers such as Li [48], Wach, et al. [49], Pavlik [51] concur that the rapid spread of GenAI towards the end of 2022 presented significant challenges, primarily due to the absence of practical case studies demonstrating the technology's benefits or impacts. This has led to considerable uncertainty regarding its effective and safe application within society.

In summary, GenAI is heralding a period of potential transformation, enriching society's content landscape and elucidating both the capabilities and limitations of this technology. However, the bibliometric review, combined with insights from recognized authors and expert judgments by researchers, has identified various controversies, threats, shortcomings, and disadvantages associated with the use of GenAI to date. Consequently, the present study has delineated a set of pressing challenges: 1) The urgent need to establish a regulatory framework governing the use of this technology; 2) The necessity for enhanced controls over data quality management to mitigate risks of misinformation, false content, and algorithmic bias; 3) The imperative to develop social surveillance mechanisms to safeguard data privacy; 4) The establishment of rules and regulations aimed at strengthening ethics in mathematical algorithms, promoting the common good, and preventing social manipulation. These findings underscore a significant opportunity for development.

5 Discussions

The findings show the principles and challenges to be followed, given the growing gap between GenAI and ethics, since some aspects require an in-depth approach, to ensure its successful use and to reduce any negative impact.

Among the problems to be addressed is the lack of a regulatory framework. This makes it difficult to establish the basis for ethical conduct, as well as the guidelines by service providers when developing mathematical algorithms for the establishment of legal, moral, professional, social, and other responsibilities and their interrelation, to ensure an integrated, dependable, and secure platform. Wach, et al. [49] underline the need to create optimal and equitable conditions. Abbott and Rothman [65] argue that the lack of regulation can radically affect principles, such as infringement, style protection, and fair use when generating content and protecting copyrights.

Therefore, to build public confidence in this transformative technology, any legislation formulated to regulate and control the activity of AI must be based on the most general lessons regarding the rules applicable to people, machines, and other synthetic decision-making processes.

However, establishing rules and regulations does not guarantee that mathematical algorithms are developed to promote the common good and avoid social manipulation, as part of ethical principles. Mannuru, et al. [64] stress the importance of using GenAI as an inclusive technology solution., rather than deepening existing inequalities, with change as a crucial determinant of growth, even if rules and regulations lag technology.

The problem arises from the lack of best practices in the industry to establish a roadmap for ensuring social equity, data privacy, and unbiased decision-making. This violates the rights and values of individuals in the various autonomous processes used by LLMs based on GenAI. Budhwar, et al. [58] indicate that to mitigate risks of data breaches should prioritize ethical issues, giving priority to data security and privacy as a priority.

Therefore, as part of their business strategy, organizations must accelerate the transformation of their processes to ensure, from a systemic approach, that all components involved in developing mathematical algorithms are considered, thus reducing biases, such as algorithmic discrimination. Budhwar, et al. [58] propose that, to avoid manipulation and the weakening of ethics will be essential to apply responsible ethical AI guidelines.

However, the lack of controls for quality management in GenAI-based technological solutions allows the promotion of misinformation, false content, and algorithmic biases, becoming in industry and science. Budhwar, et al. [58] mention that the AI arms race has accelerated since its launch, creating continuous uncertainty while increasing risks, misinformation, biases, context insensitivity, privacy issues, and ethical dilemmas. Consequently, developing a model based on algorithmic justice, addressing pillars of privacy, transparency, and social responsibility, will be the guiding framework for the ethical approach in this field, allowing for the reduction of discrimination.

All the above, from the perspective of the researchers, are lines of action that should be considered by the companies providing AI technologies. Then they can establish the principles for the development of technological platforms in a way that ensures fairness and reduces algorithmic discrimination.

5.1. Ethical implications in digital platforms based on generative artificial intelligence

The use of Digital Platforms, GenAI tools like ChatGPT 3.0 to 4.0 (and so on), and Bots for the future depends on

regulation, and regulation depends on education to the people. We need to educate the businesspeople, and the population in schools and universities, and establish rules to avoid troubles or violation of rights of the people in fields like:

1 Promotion of education about data privacy.
2 Autonomous decision-making.
3 Traffic regulations that ensure public safety.
4 Employment equity.
5 Probation or sentencing.
6 Biases in mathematical algorithms.
7 ChatGPT platform bias.
8 Automation machine learning concerns about copyright infringement and privacy laws.

All topics mentioned above need regulation, and country by country is going to be different but we need to establish a standard to be competitive, and sustainable and update the system and dynamic of the policy of regulations based on the:

1 Continuous improvement for integrity.
2 Trust of users.
3 Feedback from users and providers of information.

The most important thing for all the people and institutions involved is to respect the integrity of information, the data privacy and prevent ethical issues with all stakeholders. If we get a world of automatic improvement of information, and respect for the citizens, businesses, schools, universities, and businesspeople, we have advance for the society.

6 Conclusions

The study underscores the growing technological awareness and its profound societal impacts, emphasizing the need to address its implications for the common good. The discussion explored the principles of algorithmic fairness, privacy, transparency, and accountability, noting how these can lead to ethical biases, such as discrimination. These principles are crucial for ensuring ethical and responsible use and serve as foundational guidelines for evaluating the application of technology in various contexts.

The research identified significant ethical challenges in Generative Artificial Intelligence (GenAI), drawing from a review of one hundred and fifty selected scientific articles. Key issues such as algorithmic justice, algorithmic discrimination, and data privacy were highlighted, underscoring the necessity for thoughtful consideration of how technology can contribute equitably and fairly to society. Additionally, autonomous decision-making has emerged as a critical area, with the need for transparency in these processes being paramount to building trust in their adoption.

This research concludes with a call to ongoing action. Ethics in GenAI transcends academic discussion and becomes an ethical and social imperative, demanding engagement from diverse stakeholders, including researchers, developers, entrepreneurs, policymakers, and citizens. An informed dialogue and diligent action are required to ensure that technology inclusively benefits society.

6.1. Recommendations

1 Periodic Updating: Given the rapid development of GenAI and AI, this review should be frequently updated to incorporate new findings and maintain the relevance of the recommendations.
2 Broaden Linguistic and Geographic Scope: To achieve a global understanding of ethics in GenAI, future reviews should include literature in multiple languages and consider perspectives from various global regions.
3 Inclusion of Cross-Sectoral Perspectives: Future research should engage stakeholders from industry, civil society, and other sectors to ensure a balanced and comprehensive viewpoint.
4 Exploration of Practical Solutions: There should be a focus on identifying and developing practical solutions to the ethical challenges posed by GenAI, including the implementation of codes of ethics and guidelines.
5 Interdisciplinary Engagement: Encouraging collaboration among researchers, developers, policymakers, and citizens is crucial for fostering informed discussions and effective actions in the field of GenAI ethics.

Implications: The practical implications of these findings necessitate a shift in the approach to emerging technologies in the digital era. This research will serve as a guide to ensure the success of individuals, companies, and future societal leaders. It provides a roadmap for stakeholders to promote strategies based on informed decision-making and to comprehend the role of technology in safeguarding infrastructure, data, and individuals.

From a theoretical perspective, the implications include advancing research in academia, adding new dimensions to the understanding of processes and procedures in GenAI, and the resilient role of stakeholders in the digital age. This ensures that future research lines are diverse, reflecting the recent, broad, and complex nature of this field of study.

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Project management performance in Ecuador: proposal for a structural model

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Abstract
This research aimed to evaluate a structural model that explains the performance of projects based on four critical success factors: client communication, monitoring and planning, senior management, and technical activities, resulting from the process of adaptation and validation of the Project Implementation Profile (PIP) instrument in the Ecuadorian context. The adapted PIP was distributed online to directors involved in projects conducted in Ecuador, obtaining 328 responses. SMART PLS 4 was used to study the equations of the structural model and its multi-group analysis among project team leaders and members. The evaluation showed that the model's explanatory power was moderate, and the proposed relationships between technical capabilities, senior management, and performance were positive and statistically significant. The multigroup analysis demonstrated differences in the perception of project success between leaders and team members. The results of this study contribute new knowledge in the area of project management to the Ecuadorian Academy.

Keywords: project management; critical success factors; success criteria, PLS-SEM; multigroup analysis

Desempeño de la gestión de proyectos en Ecuador: propuesta de un modelo estructural

Resumen
Esta investigación tuvo por objeto evaluar un modelo estructural que explica el desempeño de los proyectos a partir de cuatro factores críticos de éxito: comunicación con el cliente, seguimiento y planeación, alta gerencia y capacidades técnicas, resultante del proceso de adaptación y validación del instrumento Perfil de Implementación del Proyecto (PIP) al contexto ecuatoriano. El PIP adaptado fue distribuido online a directores e involucrados en proyectos realizados en Ecuador, obteniéndose 328 respuestas. Para el estudio de las ecuaciones del modelo estructural y su análisis multigrupo entre líderes y miembros de equipos de proyectos se utilizó SMART PLS 4. La evaluación dio como resultado que el poder explicativo del modelo es moderado y que las relaciones propuestas entre los factores críticos capacidades técnicas y alta gerencia y el desempeño son positivas y estadísticamente significativas. El análisis multigrupo demostró diferencias de percepción sobre el éxito del proyecto entre líderes y miembros de equipo. Los resultados de esta investigación contribuyen con nuevo conocimiento en el área de la gestión de proyectos a la academia ecuatoriana.

Palabras clave: gestión de proyectos; factores críticos de éxito; criterios de éxito, PLS-SEM; análisis multigrupo

1 Introduction

All organizations, without exception, face changes in their environment that generate problems or new opportunities, which they must resolve [1,2], and that is when they turn to project management since this is a relevant factor for achieving their strategic objectives and a means to become competitive [3-5], as long as the proposed projects are successful [6]. This has been the motivation for academics in the last fifty years to propose several models of criteria that define the success of projects [7]: the Barnes triangle (time, cost, and quality) [8], the Project

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Implementation Profile (time, cost, performance, perceived quality, and client satisfaction) [9], a theoretical model of information systems [10], the diamond approach (efficiency, client impact, team impact, business and success, and preparation for future) [11], the success of project management and deliverables [12], and the generic model of Zwikael and Meredith [13].

However, for the study of project success, in addition to the success criteria, the critical success factors are the other components that define it [14]. Like success criteria, critical success factors have also been studied over the same time, resulting in some frameworks [15]: the Project Management Environment Survey [16], the survey of Baker, et al. [17], whose dimensions are project manager, team engagement, team project capacities, planning and control among others, the seven factors of Morris and Hough [18], the Project Implementation Profile [19], the practices of project management, deliverables management, and corporative success [6], the project, team project, organization and environment factors [20], and the factors by stage of Khang and Moe [21].

When asked why critical factor frameworks and project success models continue to be proposed, the answer is that no single list can be applied to all projects equally since the characteristics of the context influence the project itself [22-26].

Organizations in Latin America are not characterized by good performance in managing their projects, which is reflected in the fact that they register a rate of 15% of failed projects and monetary losses of 122 million for every billion dollars invested [27,28]. Such organizations are less likely to realize their strategic goals, obtain expected benefits, and become more competitive [29]. However, in these studies [27,28], no indicators were reported by country, so the specific situation of Ecuador was not known. Starting from the fact that research on project performance in Ecuador is scarce, Arteaga [30] conducted an exploratory study that revealed that of every 100 projects, only 27 were classified as high performance. That is to say, in Ecuador, the performance of project management, as in Latin America, has a lot to improve, and it is relevant to identify the critical factors and success criteria of Ecuadorian projects, the first step being the identification of a measuring instrument for each of these components.

Among the critical success factor frameworks identified by Ika and Pinto [15] is the Project Implementation Profile (PIP) by Pinto and Slevin [19], recognized as a project diagnostic instrument that covers human and managerial aspects through 10 factors that have positive and statistically significant relationship with project success [31]. Shortly after, Pinto and Slevin [9] added a section to measure project performance to the PIP among the success models reported by Ika and Pinto [7]. Consequently, the PIP facilitates the measurement of the two components of project success [14]. However, despite its versatility, it has not been used in the Ecuadorian context, except in the study by Padilla et al. [32], who analyzed the ten critical success factors in technological projects. For all of the above, Arteaga-García and Portalanza-Chavarría [33] adapted and validated the PIP to the Latin American context, resulting in an instrument of 28 items (23 for factors and 5 for success criteria) with adequate consistency and validity indices to evaluate the performance of Latin American projects, mainly Ecuadorian.

In addition, they proposed a measurement model to explain project performance based on four factors: Client communication, monitoring and planning, technical activities, and senior management. Among future research, the authors suggested evaluating the structural model and using multigroup analysis techniques to carry out comparative studies of the model. Therefore, the purpose of this article is to evaluate the structural model to determine whether the resulting four critical success factors positively and significantly impact project performance and to employ multigroup analysis techniques to make comparisons of the model according to the role played in the project by the interviewee (leader or team member).

2 Methodology

To evaluate the structural model, 328 responses were considered, corresponding to professionals who had led or participated in Ecuadorian projects, collected through an online questionnaire available on the Question Pro platform between July 2022 and the end of January 2023. The questionnaire link was distributed to members of the PMI Guayas chapter, postgraduate students in Project Management, and professional members of thematic groups on Project Management on the professional network LinkedIn. This social network was selected because it brings together professionals who are primarily active in the workplace, and they can be segmented by area of interest, in this case, project management. In addition, it is possible to access groups interested in specialized topics in project management, which facilitated sharing the questionnaire with the study's target population.

Since there is no access to the databases of project managers from the three sources mentioned to apply probability sampling, non-probability convenience sampling was used.

Of the study participants, 63% were male, 70% were under 40, and 97% had completed university education, with 42% holding a master's degree. The projects evaluated were diverse, with 57% being carried out in large companies, 79% having a duration of less than two years, and 70% having a budget of less than US$500,000. These projects were managed with various approaches, with 70% using predictive and hybrid methods. However, what stood out was the influence of the Project Management Institute, with 43% of the cases using their best practices.

In this quantitative research, the adapted PIP proposed was used, composed of 28 items measured with a seven-point Likert scale (1 strongly disagree—7 strongly agree). The critical success factors were calculated with 23 items: Client Communication (7), monitoring and planning (8), technical activities (3), senior management (5), and five items for performance.

A translation and re-translation procedure was used since the PIP instrument was originally written in English. It included the collaboration of professional and academic project management experts and certified translators to validate its content and adapt it to the Latin American context. For the validation of constructs, exploratory factor analysis was used with the unweighted least squares method and Varimax rotation.

Convergent validity is confirmed. This instrument registers a Cronbach's Alpha and a composite reliability greater than .7 [34, 35], factor loadings equal to or greater than .7, and an AVE greater than .5 [35,36]. It also meets discriminant validity under the Fornell and Larcker [37].

The Smart PLS 4.0 software was used to evaluate and analyze the structural model in multigroups according to each participant's role in the project [38].

PLS-SEM was selected as a multivariate statistical modeling technique because it is robust with small samples and does not require the normality of the variables' data, unlike the SEM technique.

3 Results

3.1 Structural model evaluation

A structural equation model was estimated to determine if the critical success factors, client communication, monitoring and planning, technical activities, and senior management positively and significantly impact the projects' performance. As seen in Table 1, technical activities and senior management have a positive and statistically significant association with the performance of projects in Ecuador. However, client communication, and monitoring and planning factors positively affect project performance but are not statistically significant. The model's absolute and incremental goodness-of-fit indices are satisfactory (SRMR=.048; NFI=.879) [36]. The independent constructs have no collinearity problems since the VIF values are less than five [39].

Regarding the explanatory power of the model, it is considered moderate, given that the coefficient of determination (R^2) is .572 [40,41]. The PLS prediction procedure was executed to evaluate the model's predictive power: its ability to predict new or future or future observations [42]. Since the prediction errors are biased, the MAE (mean absolute error) was used as a metric, whose values are compared with those generated by the linear regression model (LM) (see Table 2). For all performance indicators, except D2, the PLS-SEM analysis records lower MAE prediction errors than the LM, indicating that the model has medium predictive power [43].

Table 1.
Coefficients of the structural model.

Relation	Coefficient	P- value	VIF	Hypothesis
Technical activities -> Performance	0.328	***	2.144	Supported
Senior management -> Performance	0.244	***	2.451	Supported
Client communication -> Performance	0.145	0.056	2.362	Rejected
Monitoring and planning -> Performance	0.153	0.093	2.853	Rejected

Footnote: *** p < .001
Source: Prepared by authors

Table 2.
The predictive power of the structural model.

Performance	PLS-SEM_MAE	LM_MAE
D10	0.63	0.659
D11	0.655	0.707
D2	0.973	0.972
D3	0.718	0.754
D4	0.721	0.73

Source: Prepared by authors

3.2 Multigroup analysis

For the multigroup analysis, the variable Role in the Project was used, from which two groups were established, the one made up of leaders or coordinators of projects G1 (n = 164) and that of the project team members G2 (n=164). Before proceeding with the multigroup analysis, measurement invariance was checked using the compound modeling procedure (MICOM) [44], demonstrating the invariance of all compounds, as well as the equality of their means and variances (see Table 3).

Subsequently, the multigroup analysis was carried out under the PLS-MGA option, the results of which are presented in Table 4. The existence of a positive and statistically significant relationship between the technical activities and senior management constructs with the performance of the projects is confirmed for both project managers and project team members, while only for project managers it is confirmed that there is a positive and statistically significant relationship between client communication and performance. For their part, for team members, it is confirmed that there is a positive and statistically significant relationship between monitoring and planning and project performance.

Table 3.
MICOM results

Compound	Original correlation	5% quantile empirical distribution	Permutation p-value	Original mean difference	Permutation p-value	Original variance difference	Permutation p-value
Technical activities	0.999	0.998	0.136	0.051	0.651	-0.232	0.358
Senior management	1	0.999	0.736	0.086	0.44	0.076	0.726
Client communication	0.999	0.998	0.084	0.04	0.722	0.162	0.414
Performance	1	0.999	0.578	0.18	0.107	-0.244	0.395
Monitoring and planning	1	0.999	0.638	0.022	0.844	0.151	0.456

Source: Prepared by authors

Table 4.
Structural model: Multigroup analysis of Project Managers vs. Team Members

Relation	G1: Project Managers			G2: Team members		
	Standardized Coefficient	P-value	Hypothesis	Standardized Coefficient	P-value	Hypothesis
Technical activities -> Performance	0.429	***	Supported	0.209	**	Supported
Senior management -> Performance	0.209	**	Supported	0.27	**	Supported
Client communication -> Performance	0.237	**	Supported	0.113	0.254	Rejected
Monitoring and planning -> Performance	-0.005	0.97	Rejected	0.293	**	Supported

Footnote: *** p < .001 ** p < .05
Source: Prepared by authors

1 Conclusions

The Project Implementation Profile is among the most notable frameworks in the literature regarding critical factors and measurement of project success [7,15]. Because of its versatility, it has been used to evaluate projects with diverse characteristics in different contexts [45-48] and with limited use of the instrument in technological projects in Ecuador, and this motivated the adaptation and validation of the complete PIP for the Ecuadorian context, which resulted in a new instrument and a measurement model that proposes to explain the performance of projects based on four factors: Client communication, monitoring and planning, technical activities and senior management [33].

The structural evaluation of this proposed model, based on the entire sample collected, generated results that partially coincide with Pinto [31] since although the four factors present positive standardized coefficients, only two are statistically significant to explain the performance (success) of Ecuadorian projects: Technical activities (availability of technology and experience required to carry out specific technical activities) and senior management (willingness of senior management to grant resources and authority necessary for the success of the project). Additionally, the model does not present collinearity problems between constructs, its goodness of fit indices is satisfactory (SRMR= .048; NFI = .879), its explanatory power is moderate (R^2 = .572), and its predictive power is medium.

Contrary to what was stated by Malik et al. [49] regarding the fact that the factors associated with communication positively and significantly impact the success of the projects, since the participation and commitment of those involved are ensured [50], the client communication factor (consultation and validation with the involved-on project topics) was not significant in explaining the performance of the projects. Likewise, although Ward [51] points out that effective planning and control of work, resources, and time ensure the success of the project, categorizing it as a success factor [52], monitoring and planning (planning and control of the scope, budget, schedule, resources, and project risks) is also not a significant factor. To investigate this finding further, the variable role in the project was selected to perform a multigroup analysis of the structural model, classifying the sample into two groups: leaders or coordinators (G1) and members of project teams (G2).

In both groups, the finding is reconfirmed that the factors of technical activities and senior management have a positive and significant impact on the success of the projects. Furthermore, it is confirmed that client communication and, monitoring and planning factors also positively and significantly affect project performance in different groups. For managers, client communication is the second most relevant construct to explain project performance after technical activities, while monitoring and planning do not affect the model. On the contrary, for team members, the construct of monitoring and planning is the most important, followed by senior management, and they consider client communication as the factor that contributes the least to predicting the project's success.

These results highlight the different perspectives of those involved in a project, depending on their role. A manager values having the most qualified technology and technical personnel to achieve their results, which is impossible if they do not maintain constant communication with those involved to validate their deliverables and the support of senior management to complete their project successfully.

The team members value that the project manager applies good project management practices that generate robust planning and monitoring processes and that the most appropriate technology is available to effectively carry out the project work. They also hope to have the support of senior management so that if there are problems during the project's life cycle, immediate solutions can be reached. In business practice, these findings help human resources departments develop training and coaching plans that are differentiated by the employee's role in the project to enhance their management of critical success factors to achieve more effective project management. Project managers can also use the adapted PIP to evaluate their projects and identify whether they are appropriately managing the four critical success factors considered relevant in the Ecuadorian context, thus also quantifying the degree of success in managing their projects and deliverables. The results of the evaluations will contribute to the detection of strengths and opportunities for improvement to achieve successful project management that contributes to the attainment of sustainable competitive advantages in the beneficiary organizations.

Among the limitations of the study, it could be considered that in the analyzed sample, the participation of projects with an agile approach was low, so the results obtained are not generalizable to this category of projects. The use of the agile approach is deeply rooted in projects with a high degree of innovation, which implies that the definition of objectives, deliverables, and expected benefits is built incrementally or iteratively. A study focused on this type of project would be appropriate to determine their critical success factors and what criteria determine whether or not they are successful.

In addition, there is bias due to the common method variance because it is research based on the survey method, and the selection and accessibility biases are due to the use of the LinkedIn social network in the collection of cases. For the common method variance bias, the procedural remedies of Podsakoff et al. [53] were applied, such as the careful construction of the items and the request to read and subsequently accept the informed consent to the participant before filling out the questionnaire, where anonymity is guaranteed. He is encouraged to respond objectively and honestly to minimize socially desirable responses. To mitigate the selection and accessibility biases from compromising the study results, two additional sources of cases were considered: the postgraduate courses in project management and the PMI Guayas chapter.

As future research, it is proposed to make other comparisons of perspectives through multigroup analysis considering variables such as the size of the project, size of the organization benefiting from the project, or approach to the project (predictive vs. hybrid) to investigate further under what contexts they are confirmed or not the proposed relationships between the four factors and project performance.

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Analyzing emotion in Project Management

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Abstract
This article analyzes different ways emotions have been studied and applied to promote better communication and working conditions, leading to more successful projects and helping build stronger relationships between members. Project management relies on emotions because it depends on human communication and interactions, which can help reduce or escalate conflict. Emotional closeness is essential in interpersonal interactions and relationships. It is also essential to motivate members. Special attention is given to communication inside project teams since it is essential in building trust and developing strong relationships. When emotions are handled adequately, trust and strong bonds develop. In project management, members are bound together by a sense of common identity, sharing professional values and interests. The stronger the connections between members, the higher the productivity and support. Specific ways to connect in project management emerge due to the very nature of projects and the closeness of the members.

Keywords: project management; emotions; positive; negative; communication; engagement.

Analizando las emociones en la Gestión de Proyectos

Resumen
Este artículo analiza las diferentes formas en que se han estudiado y aplicado las emociones para promover una mejor comunicación y condiciones de trabajo, lo que conduce a proyectos más exitosos y ayuda a construir relaciones más sólidas entre los miembros. La gestión de proyectos se basa en las emociones porque depende de la comunicación e interacciones humanas, lo que puede contribuir a reducir o aumentar los conflictos. La cercanía emocional es un aspecto importante de las interacciones interpersonales y las relaciones. También es esencial para motivar a los miembros. Se presta especial atención a la comunicación dentro de los equipos, ya que es esencial para construir confianza y desarrollar relaciones sólidas. Cuando las emociones se manejan adecuadamente, se desarrolla la confianza y también se fortalecen los vínculos. En la gestión de proyectos, los miembros están unidos por un sentido de identidad común, compartiendo valores e intereses profesionales. Cuanto más fuertes sean las conexiones entre los miembros, mayor será la productividad y el apoyo. En la gestión de proyectos, surgen formas específicas de conexión debido a la naturaleza misma de los proyectos y la cercanía de los miembros.

Palabras clave: gestión de proyectos; emociones; positivas; negativas; comunicación; compromiso.

1 Introduction

Project management has become one of the leading ways of working in organizations, and numerous businesses perform most of their work through projects. Projects have important restrictions, particularly triple constraints, which involve cost, time, and scope [1], positively or negatively affecting the resulting quality. One of the most valuable elements of working on projects is what develops inside a small group in terms of collaboration because individual contributions are visible, which does not happen when the organization is too large. The smaller the group, the more likely project members will participate in discussions, focus on issues, show initiative, and be more interested in offering solutions [2]. This also reduces perceived conflict due to others' points of view.

The relationships between emotional intelligence and project success have been explored [3] under the assumption that managers with higher emotional intelligence manage their responsibilities differently, inspiring members. The importance of emotional management, especially in adverse conditions, has also been reported, highlighting ways in

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which it helps build reliable, healthy, and productive relationships, social connections, and better ways of communication [4].

Emotions are required to communicate effectively [5]. Adequate management of emotions when communicating with others can lead to positive and joyful encounters, while the opposite can lead to hostile environments that hinder interactions and collective efforts [6]. Due to their importance, emotions are increasingly analyzed in the workplace and project management, including emotional intelligence and awareness in project management [7]. Positive and negative emotions, such as anxiety, excitement, passion, and nervousness, which occur in different stages of the project lifecycle, can help or harm projects since they can influence team performance [6,8]. Due to their time frame being shorter than other activities, project work can become stressful, and stress is one of the significant factors that destroy effective communication. Therefore, emotional intelligence becomes essential in project management [5,6,8] as a preventive strategy to manage the negative influences of conflict [9].

Tolerance and compassion are among the soft skills most required to develop successful projects. They are the essence of peacemaking, and peacemaking is at the heart of life [10]. Emotional closeness has been described as the degree to which individuals perceive others to have caring feelings for them and be emotionally supportive [11]. Essentially, it brings people together, related to the idea of community and group flow, which refers to interactions [12].

The idea of a united and loving family that brings advantages to business helps explain moments of high performance, synchrony, and a sense of being "in the zone"; it is a state of unselfconscious awareness in which every individual action seems to be right, and the work appears to work in synchronicity [12,13].

In dancing, playing music, and sports, togetherness involves listening, awareness of self and others, and relatedness as it is experienced, or better yet, how bonding the relationship feels. Togetherness can be connected to Bauman's idea of being-for [14]. “Being-for is a leap from isolation to unity; yet not towards a fusion, that mystics’ dream of shedding the burden of identity… being-for is entered for the sake of safeguarding and defending the uniqueness of the Other; and that guardianship undertaken by the self as its task and responsibility makes the self truly unique, in the sense of being irreplaceable” [14].

In projects, every decision made in the team is collaborative and shared [15], which leads to a sense of community. It has been demonstrated that creating a sense of community in the workplace and in project management makes most work more satisfying, creative, productive, profitable, and cost-effective [16] because relationships precede obligations, and reciprocal obligations flow from personal relationships, helping create both one’s identity and that of the group [17].

This results in increased support and a unified common purpose. When people participate in everyday practices, they become dependent on each other, making collective decisions and committing themselves to their well-being and that of others and the group [18].

Organizing through projects is essential since it warrants that the means are prioritized in service of the project's objectives. Project work is an example of subsidiarity because the project manager and the team are entrusted with huge responsibilities [19].

Collective ownership develops; each member feels that they have a duty to act to protect and care for something that is theirs. There must be specific rules of management, monitoring, and compliance with the rules. There is pro-organizational and collectivistic behavior, such as collective production, in which the members deliver services in reciprocal relationships, which helps strengthen the capabilities of all members.

2 Materials and methods

The methodology used to develop the research was the literature review. Information was collected from various sources, especially Scopus, Web of Science, EBSCOhost databases, business publications and information from the Project Management Institute and mainstream media. The key words used were emotions, emotion management, emotional intelligence and project management. The sources were evaluated, the information was synthesized, and the most relevant ideas about emotions in project management were set forward to identify existing gaps on the topic, which can be further explored in research.

3 Results

3.1 The emotional economy and emotions at work

Goleman has stated that every interaction has an emotional subtext, which can lead us to make people feel better or worse. The moods we perceive and feel will last longer than the interaction or the encounter, resulting in an emotional afterglow [20]. Every interaction has gains and losses, which leads to the emotional economy.

There is a common belief that emotions interfere with work, but studies have found that the opposite is true. Emotions have been considered the way to achieve better working experiences [21]. Emotions are influenced by events that happen at work [22]. People who experience positive emotional states are more proactive, flexible, and goal-oriented [23].

Showing emotions at work is considered to boost productivity. According to different studies, two-thirds of workers suggest that showing their emotions at work makes them more productive, and nearly half are more comfortable doing so now than they were pre-pandemic [24].

Working on projects elicits many emotions, and sometimes, such emotions start with the fear of the unknown for those who have never worked on projects before. Also, since people from different areas and levels will be working together, there is a fear of misunderstanding others.

Projects sometimes produce extreme environments, amplified by urgency [25], creating spaces for extreme emotions. Interpersonal emotion regulation is essential for an adequate organizational life, although people tend to suppress emotions most of the time.

Emotional training has been used to promote positive feelings at work. It includes cultivating confidence, autonomous initiatives, responsibility, and productivity [26]. Emotional training also helps avoid burnout and understand how to deal with others' emotional outbursts, as well as antipathies, envy, resentment, and even anger.

3.2 Communication: the essence of understanding other's emotions

Nothing is worse than talking to someone and feeling that one is not being listened to. The effectiveness of good communication relies heavily on the ability to empathize with and listen to people at all levels [27]. Language, or at least a common vocabulary, is of the essence in communicating. The importance of sharing a language lies in reinforcing a similar way of life and in understanding or appreciating the other's different interpretations or points of view. Still, it is important to understand that having a common vocabulary does not necessarily presuppose a common meaning to the concepts shared [17].

In order to increase trust, communication needs to go two ways: be fair and dependable and show competence. When employees need to tell their leaders bad news about the project not going as expected or about needed changes in the scope, time, or cost, they might not be eager to speak. By contrast, when the project is right on track or when unexpected positive things happen, such as reducing costs, it is easy to get and provide information to others. In good times, everyone wants to share the good news. Natural obstacles to trust and candor include fear, pride, politics, and dislikes.

In hierarchical organizations, people in lower positions tend to be more cautious about disclosing problems, weaknesses, mistakes, and failings and resort to self-protection, sometimes hiding valuable information. For instance, people sometimes keep quiet about a developing problem because they think that they might be able to solve it or that it would eventually solve itself. They hide the information to protect a client instead of losing him.

Trust takes time to build, yet it can be destroyed quickly. Betraying confidence, breaking a promise, humiliating, lying, withholding information, excluding someone—the list is endless—can destroy trust. Project leaders can also destroy trust by not giving credit to other members when they deserve it.

The most important signs of trust being broken are when the information flow deteriorates, and valuable information does not reach the adequate stakeholders. The group's morale is low, there is a lack of enthusiasm and engagement, reduced cooperation, and complaints emerge regarding the workload, the overall working conditions, and events about other members, further eroding personal relationships. Members will start to avoid dealing with problems, which will end up being dumped onto other members or the leader.

As trust evaporates, employees will be unwilling to speak the whole truth, withholding important information, and their messages will become ambiguous. It will be possible to identify certain non-verbal signs, such as increasing physical distance between members, and there will be changes in routines, such as having coffee or walking to the water cooler and chatting, as well as closed doors, even with an open-door policy. Finally, evidence will come from outside the organization in the form of customer complaints, lost customers, decreased productivity, and, ultimately, deteriorating quality.

In order for people to be able to work together, they must first be able to be together so that they can communicate with each other and listen. The act of listening implies interiorizing the words of others, valuing them, and sending a sign of recognition and acknowledgment that will allow openness to new horizons and new ideas [28]. Leaders need to create conditions so that members feel secure enough to speak their minds. When speaking, it is important to be attentive to the reactions of others and how they respond.

There are multiple moments in which authentic listening can be used in business settings, such as during meetings, recruitment interviews, planning sessions, and every activity at work. Leaders need to be aware of all possibilities of communication contacts and to listen to what all members have to say. Listening is, in essence, the recognition of the other as a human person. In the same way, the leader needs to be able to listen to the silences because they convey important meanings.

Leaders need to be aware that numerous factors can negatively impact their ability to fully listen and acknowledge the other person; these include prejudices, tiredness, and the belief that we know what the other person is thinking or meaning. Therefore, leaders should avoid precipitation.

Listening is an important part of human relations. In order to develop trust, one needs to listen. Listening abilities have become of great value in today's business as they lead to understanding. When people in business fail to understand each other, the results can be costly as they may result in inefficiencies, such as errors in names, dates, and places and forgetting previous agreements [29,30]. The listener needs to refrain from firing his thoughts back to the person talking and avoid judging because it leads to a sense of rejection, which negatively affects people. Approval, on the other hand, creates a positive climate as it recognizes the value of others.

It is important to become good listeners so that people can talk freely, communication can have an adequate flow, and the message will not be distorted. Presence listening needs to be done with an openness of will, heart, and spirit, becoming unconditional witnesses with unconditional love for others while being authentic. This will result in cultivating listening abilities that are essential to function in the space of the collective.

3.3 Connecting through emotions: Esprit de corps; brotherhood, sisterhood, and fraternity; communityship and teamship

Every member needs to feel connected. Regarding the leader, employees perceive an environment in which the leader makes an effort to form an interpersonal relationship with them. In terms of peers, employees perceive an environment in which they trust their colleagues and where their colleagues make an effort to form an interpersonal connection with them [31].

Internal connectedness happens in organizations with strong values-driven cultures. Common identity strives to achieve a shared vision; they work together for the common good. This results in a sense of fulfillment for making a difference in their communities to serve humanity and, ultimately, the planet. This cultural glue makes the difference between a good company and a great *one.*

The idea of a collective soul or a mental or moral contagion stems from common ideas, attitudes, emotions, and sentiments communicated from one individual to another and propagate and multiply. In certain circumstances, and only under certain circumstances, an agglomeration of individuals possess novel and strong characters different from each individual who is part of it. Conscient personality vanishes, sentiments and ideas become oriented in the same direction, and a collective soul is formed [32].

Even when there are social and cultural differences, none of these differences oppose the psychological law of mental unity [32].

3.3.1 The spirit of the body: esprit de corps

Spirituality has always been an inherent part of project management. Some of the best examples are temples, pyramids, churches, and large monuments built at different times, in which spirituality can be equated to meaning and purpose. Modern-day project managers want to create a sense of the esprit de corps in their teams, which means understanding and honoring the team's collective spirit [33].

In French, the phrase esprit de corps reflects a connection with the community, and it is visible, especially in the military, where people's lives are at risk and when it is the collective that keeps them safe. A familiar spirit exists among members, bringing inspiration and enthusiasm, devotion, and strong regard for the group [34,35]. It also signifies common interest, responsibility, and action "and a sentiment of harmony existing among employees in smoothly functioning organizations" [36]. It is about staying strong and thriving by regularly being tested with adversity and becoming smarter and tougher [37]. Unity was the single most important element, as a "unifying set of values and beliefs" [38].

High sociability has some benefits [37], as it helps morale and esprit de corps. Community life can be fun and exciting, generous and contagious, and where individuals can share a good life together.

Blumer circular reaction [38] is a collective process in which each individual will produce stimulation to which other individuals will respond, and so will the others. Interaction processes become essential to establishing engagement. In the circular reaction, a contagion effect will happen, being passed from certain members of the collective to others as an epidemic, and the leaders will be responsible for activating the required processes to help develop the esprit de corps, which will become the foundation to ensure group cohesion [32].

When considering leadership, although followers might have an interest of their own, the leader needs to develop close relationships and create an esprit de corps so that individuals will set competing private interests aside.

3.3.2 Brotherhood, sisterhood, fraternity

The familial interdependence and responsibility for the other are founded upon a deepened and expanded conception of self-interest or the common good. The common good is based on respecting human dignity and creating a fraternal community, searching for a better life for the brotherhood of man and his community [39]. Brotherhood is a type of solidarity and fraternity and the moral cohesion of society [40] and reflects a desire for greater mutuality and reciprocity in social relations [41].

Brotherhood is achieved through strong ethics in project management, which also increases loyalty and promotes harmony and trust [42].

3.3.3 Communityship

A form of organizing characterized by collective leadership, it is reflected in personal commitment and collective engagement, as well as an energetic workforce [43]. Developed from the need for more humane and respectful organizations, it illustrates collective influence, which is the social capital in organizations [43].

Social initiatives require a leadership that is deeply embedded in communityship. The term was coined by Henry Mintzberg. It is basically about how managers are responsible for their own institutions, i.e. municipalities, as a community driven by engagements and strong ethical beliefs and standards, it is a matter of sustainability of public services and organization, rather than short-sighted beliefs in profit [44].

3.3.4 Membership

The attraction of group membership is not just the need to belong but the desire to achieve something by means of membership [45]. Associations exist to fulfill the purposes that a group has in common [46]. In clubs, membership is voluntary; individuals decide to belong because they consider that the membership creates benefits and are willing to pay a fee.

Club goods are a private alternative to the provision of public or collective goods, such as recreation facilities, theaters, military alliances, golf courses, swimming pools, and health clinics. The club can be inclusive and should involve everyone who wants to join. Each member reduces everyone's cost through sharing, as the cost spreads over a larger number of payers. In this sense, adding members creates the benefits of reduced costs. If the club is exclusive, membership size has to be limited. An exclusive club shares a good; the benefits decrease as the group size increases.

3.3.5 Teamship and teaming

Projects require teamwork. Teamship can be explained as the collective ability to work in a team to achieve common goals in an environment facilitated by strong communication [47]. Teaming is a new way of working, which implies collaboration to fulfill interdependent tasks. Edmondson has declared that it is teamwork on the fly, and an engine of

organizational learning [48]. It includes relating to others, attentive listening to different perspectives and points of view, coordinating actions, and making shared decisions. The most important aspect of teaming is that every member needs to be vigilant and aware of others' needs, roles, and perspectives [48].

In teaming, a new way of learning is required, starting with a basic mindset about human beings. People who Work in teams need to be responsible, accountable, respectful to others, understand conflict, and accept responsibility. In contrast, leaders must trust those they lead and create hospitable team-building and learning conditions. Learning together is the best way to get to know others through direct feedback and suggestions for improvement. It is about creating synergies through teamwork. Teaming is visible in orchestras that can create and maintain harmony. Teaming makes it possible to identify the skillsets of others and important aspects of their personality that can benefit the job.

Teaming has a positive effect on people's work experiences, making work more interesting, enriching, and meaningful. Employees learn from each other, and people can combine their knowledge, work together, and improve quality [48]. Teaming is about harnessing teams' energy, making everyone willing to engage and take responsibility in collective endeavors [49].

Teaming and leading require coordination and structure because it takes leadership to understand and solve conflicts and to promote conversations to improve. It is the leader who helps build shared understanding and coordinates actions. Leaders need to frame the situation for learning, make a psychologically safe space for the team, learn to learn from failure, and span occupational and cultural boundaries [48]. They must communicate a clear and compelling purpose and the need for collaboration, removing visible and invisible boundaries that create group divisions. If people do not feel safe and secure, they cannot express themselves freely. Framing is crucial for enrolling people in any substantial behavioral change, avoiding ambiguous signals, and facilitating understanding of personal and group expectations because not everyone understands work in the same way, and solving problems is unlikely to occur when people do not understand and care about a common purpose [48].

Teaming results in high-performance teams that achieve common objectives with a common orientation, the participation of all members, and a clear and stimulating objective in a favorable context.

3.3.6 Team spirit

Building a team is complex and lengthy work; it requires working intensely in the team's motion, which is related to long-term success. Team spirit includes the sense of community and the need to be recognized, respect for others, self-care, the drive for success, and the need to feel loved [50]. The team needs to be understood as a system. In a team, sound systems of relationships make suitable structures, not the other way around [50]. Team spirit includes speaking to each other simply and directly without leaving things unsaid. It is about understanding each other and mutual support. It is difficult to define it; it is lived and felt. The members are happy to be together; there is pleasure in encounters, and rituals take place.

Exceptional projects are characterized by excellent team spirit. In project management, team spirit is called project spirit. When project spirit is achieved, members are dedicated to the team's mission, support each other, and are proud to be a part of the team. Project spirit is the driver that unleashes untapped power, leading to excitement about working together and high team morale [51].

4 Ten essential, actionable recommendations for project managers

1. Create a safe space so that everyone feels safe expressing their emotions.
2. Start every day by asking the team members how they feel. Share those emotions in the group. Find similarities and differences and talk about the main causes of those emotions so that empathy can develop.
3. Validate everyone’s emotions, both positive and negative, about the project.
4. Identify positive emotions and have each member share them with others, creating a collective soul or a collective feel about the project.
5. Help develop a *spirit de corps* and brotherhood culture in which everyone is willing to help others. Promote pay-forward strategies
6. Provide training on emotional intelligence.
7. Offer emotional support when needed, professionally (therapy), or through active listening and support.
8. Incorporate emotional intelligence evaluations from the moment of talent selection and through their organizational life.
9. Use that information to create specific training programs and mutual support.
10. Develop spaces leading to better communication, empathy, a sense of community, respect, and social networks.

Conclusion

This article presents general considerations regarding emotion and work and shows positive group dynamics, which result when emotions are adequately managed inside project teams.

Engaging ways of integration and collaboration emerge when emotions are adequately managed inside the project. Strong connections are developed with a shared identity, empathy, and understanding. Connection enables the best of what the many bring for the benefit of the collective one [52]. A shared identity in project management can be connected to the nature of the project, why people are getting together to work, their mission, their values, and what makes them inspired and proud. Empathy also needs to be shared; this happens when people in the project get to know and care about each other. They are no longer strangers; they value others and are valued and are sensitive to the feelings of others [52].

In project management, shared understanding is essential.

It happens when everyone in the team is well-informed on important matters, and their opinions and ideas are valued. Conversation flows, resulting in a high degree of understanding.

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Project management in companies in the hydrocarbon sector in Colombia. A correlation analysis between economic performance and sustainability

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Abstract
The ecological damage caused by business activity and project execution is universal in nature with irreversible effects for some components of ecosystems. The literature review made it possible to highlight three of the multiple causes responsible for ecological deterioration: the organizational footprint and its effects on ecological deterioration, the regulatory component versus the perception of ecological compensation, and the itinerary in the preparation of information on sustainability based on standards. with financial scope. The analysis of these components of the problem guided its methodology consisting of analyzing information from the sustainability documents released by corporations operating in the hydrocarbon industry. in Colombia, identifying two groups of variables: the resources impacted by this sector in the environmental dimension and another economic variable that measures the performance and financial situation. Their correlation was determined by generating an analysis model and it was concluded that there is no pattern or correlation between the economic and environmental variables measured by each of the entities and revealed in the integrated information reports.

Keywords: project management; sustainability; standards; ecological compensation; management.

Gestión de proyectos en empresas del sector hidrocarburos en Colombia. Un análisis de correlación entre desempeño económico y sostenibilidad

Resumen
El daño ecológico causado por la actividad empresarial y la ejecución de proyectos es de carácter universal con efectos irreversibles para algunos componentes de los ecosistemas. La revisión de literatura permitió evidenciar tres de las múltiples causas responsables del deterioro ecológico: la huella organizacional y sus efectos sobre el deterioro ecológico, el componente regulatorio versus la percepción de compensación ecológica, y el itinerario en la elaboración de información sobre sostenibilidad basada en estándares con alcance financiero. El análisis de estos componentes del problema orientó su metodología consistente en analizar información de los reportes de sostenibilidad de empresas del sector hidrocarburos en Colombia, identificando dos grupos de variables: los recursos impactados por este sector en la dimensión ambiental y otra variable económica que mide el desempeño y situación financiera. Se determinó su correlación generando un modelo de análisis y se concluyó no existe patrón o correlación entre las variables económicas y ambientales medidas por cada una de las entidades y reveladas en los reportes de información integrada.

Palabras clave: gestión de proyectos, sostenibilidad; estándares; compensación ecológica; gestión.

1 Introduction

Incorporating sustainability into project management is crucial for enhancing the sustainability performance of projects and making sustainability the foremost concern pertaining to the performance of any project-based organization. Organizations must address the mitigation of biotic and abiotic resource impacts during the execution and

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initiation of their projects. [1]. The preservation of economic, social, and ecological sustainability is among the most significant challenges faced by our society. [2] Enterprises have come to understand that committing to sustainability, with its various wide-ranging effects, can lead to the achievement of business goals in the planning of projects.[3], It is imperative to align project management (PM) with innovation and sustainability to address evolving social demands. The growing complexity and unpredictability within the PM field have led to advancements in both theoretical and practical aspects. This evolution demonstrates a shift towards a more comprehensive and interdisciplinary approach in project management. To effectively navigate this complexity and uncertainty, it is essential to integrate innovation and sustainability into the discipline of project management [4].

Effectively managing the threat of natural disasters and other significant risks is essential for the survival, durability, and adaptability of organizations of various scales and types. It is a critical component of showcasing their dedication and responsibility to society and the broader environment, integrating efforts to address the impact of climate change. [5]. The contradiction between economic development and environmental protection is becoming more serious, and an innovative ecological compensation policy is a key measure to solve this problem [6].

Nevertheless, strategies aimed at promoting sustainability may not necessarily align with those geared toward project implementation. This discrepancy is largely due to the significant gap that exists between the implementation of projects and their subsequent sustainability outcomes. [7] Despite several studies addressing the relationship between sustainable project management and success, this relationship is still not adequately addressed [8] as well as traditional view of judging projects based on time, budget and quality/scope it is extremely relevant to discuss the social value and contribution to achieving the UN Sustainable Development Goals (SDGs) because these metrics continue to change, even after the project is completed. [9]

Activities vary from project to project and various levels of complexity are involved, so a comprehensive methodology for measuring sustainability at the level of project activities has been largely absent in the literature [10]. Ecological restoration is the most promising way to combat ecological degradation and improve ecological stability. However, it is still unclear at what scale ecological restoration is needed for the region of ecological degradation related to ecosystem services under current and future climate change [11]. The achievement of carbon neutrality by individual organizations would be unattainable without having a negative impact on their economic interests [12].

The extractive industries, which are recognized for their notable local influence, have failed to sufficiently respond to increasing stakeholders' expectations for contributing to sustainable development. [13] A case that can illustrate such a statement is offshore oil extraction which is a challenging task with multiple dangers, since oil spills, both from daily operations and accidents on the high seas, endanger the marine ecosystem of nearby waters. Unlike traditional damages (i.e. personal injuries and property damage) through the environment, non-contractual liabilities resulting from marine ecological damage require a separate regime where the relevant rules are dispersed in different legal instruments. Some unique characteristics embedded in the Chinese offshore oil industry fundamentally shape the distribution of responsibilities and approaches to ecological remediation. The Bohai Bay oil spill in 2011 showed that China urgently needed to address this issue in practice. [14]

2 Literature review

2.1 Ecological footprint and its ecosystem effects

When studying the relationship between oil consumption and economic growth in terms of carbon emissions and ecological footprint [16], an adverse effect was evident for renewable energies, showing a mitigating impact on both carbon emissions and the ecological footprint. . Furthermore, the study reveals a positive correlation between institutional quality and carbon emissions, with a contrasting negative effect of institutional quality on ecological footprint at lower quantiles. A positive correlation is found between institutional quality and the ecological footprint in the upper quantiles. This study advocates an integrated resource policy that strategically incorporates renewable energy to mitigate carbon emissions and ecological footprint.[17] showed that both natural resource rents and industrial changes considerably influence the ecological footprint. Unlike previous non-spatial studies, this research fuses spatial panel data analysis, emphasizing the regulatory role of juxtaposing natural resource rents with the adjustment of the industrial structure, potentially reducing the impact of economic growth on the ecological footprint.

The energy indicators of African countries [18] the findings indicated that the revenue generated from fossil fuel resources and their usage are substantial contributors to environmental degradation, leading to a notable increase in the ecological footprint among nations. Additionally, the escalation of economic growth and globalization further exacerbates the strain placed on the environment. The detrimental environmental effects of rapid urbanization across countries were also observed. Furthermore, it was determined that the environmental Kuznets curve (EKC) hypothesis, which suggests an inverted U-shaped relationship between ecological footprint and income, was refuted for the overall panel of nations due to their disparities.

2.2 Ecological compensation

The concept of ecological compensation has gained widespread acceptance globally as a result of the imbalances stemming from the rapid advancement of modern society, economy, and the environment, leading to heightened strain on ecosystem carrying capacities. Nevertheless, there exist notable discrepancies in the quantification of ecological compensation standards. Thus, it is imperative to comprehend the procedure behind establishing a rational ecological compensation threshold. [19]

Monetary compensation is, of course, a vital legal remedy to comply with ecological remediation. the legal regulations

applicable in China regarding offshore drilling based on a legal and economic approach. This methodology not only addresses the adequacy of compensation, but also whether the applicable rules provide adequate incentives for prevention. In this way, in this type of study the meaning of compensation is limited to an issue of economic compensation and not the recognition of an ecological liability that can be considered.

For several years, Nigeria has been dedicated to the business of oil exploration, prospecting, and marketing, serving as a benchmark in this field. Unfortunately, this has led to the loss of biodiversity and the alteration of the ecosystem. Despite the existence of laws in Nigeria aimed at protecting the environment, there is a lack of comprehensive legislation addressing the issue of compensation and responsibility for those affected by environmental damage. As a result, the compensation received by local people is often unpaid, inadequate, delayed, or contentious, leading to increased poverty. It is important to note that no amount of money can fully restore oil pollution, as a damaged ecosystem cannot be easily repaired. [20]. No matter how much money is paid as compensation in the meantime, the fact is that there is no such thing as restoring oil pollution, because a broken ecosystem cannot be repaired the way a broken bone can [21].

2.3 Regulatory component versus the perception of ecological compensation

To understand the dynamics between consumption and environmental factors [22] Two different models were employed in this investigation. The first model took into consideration carbon emissions, while the second model assessed ecological footprint factors. The study's results demonstrate a direct correlation between oil consumption and economic growth in terms of both carbon emissions and ecological footprint. In contrast, renewable energies were found to have a beneficial impact by reducing both carbon emissions and ecological footprint. Furthermore, the research revealed a positive relationship between institutional quality and carbon emissions, with a contrasting negative effect on ecological footprints at lower levels. However, a positive correlation was observed between institutional quality and ecological footprint at higher levels. The study also examined biodiversity compensation policies, their development, and implementation. [23] depends on the quality of specialized ecological data and requires anticipation, planning, monitoring and control.

The comparison of France and Colombia revealed that the geographical, ecological, and legal factors, including a country's geographic features and legal framework, play a significant role in the effectiveness of compensations. High compensation rates may rely on the allowance of preservation measures, in addition to restoration, as well as the limited availability of space. It is important to find a balance between the legal certainty offered by predetermined ratios and the policies' effectiveness in preventing a net loss of biodiversity.

Efforts to combat climate change [24] Many are still unsure about how economies will attain emissions reductions by 2050. This involves increasing awareness about risks and strategies, enhancing corporate responsibility, staying nformed about policy changes and regulations, promoting fair energy transitions, energy democracy, divestments, alternative market solutions, and postponing or cancelling specific hydrocarbon activities. While institutional methods are commonly used to support policy change and regulation, they do not generally contribute to raising awareness or delaying outcomes.

2.4 Standards used in sustainability project management

Projects are essential for achieving more environmentally-friendly business practices. A growing area of interest in project management research is the connection between projects and sustainability. [25] A novel, unique, and evolving ideology in project management has emerged. The key elements of this sustainability-focused approach include viewing projects through a social lens, implementing a stakeholder management strategy, utilizing Triple Bottom Line criteria, and embracing a Values-based approach to projects and project management. Recognizing the pivotal role of projects in enabling these shifts, [26] the concept of sustainability must be integrated into the way projects are selected, prioritized, executed, managed, governed and evaluated. This requires the integration of sustainability into organizational strategy, project portfolio management and project management. However, studies on sustainability in business describe the application of sustainability concepts mainly at the level mentioned above in isolation, with little or no attention to the links between the strategy, portfolio and project levels. [27]

Despite the substantial rise in academic publications on the intersection of sustainability and project management, a notable disparity exists between the theoretical models, tools, and frameworks outlined in scholarly works and the practical application found in project management guidelines. Sustainability aspects remain a key area in need of alignment. [27] are external to the base project, but may need to be included, as the success of the project will be evaluated according to the organization's policies. PRINCE, the PMbok Guide and the International Competence Baseline on stakeholder issues and sustainability conclude that none of the three explicitly consider sustainability issues.

The International Organization for Standardization (ISO) is working on a new set of standards for sustainability and resilience, starting with ISO 371001. However, it does not directly address project management, although the focus on management systems could also apply to the projects. ISO26000 Social Responsibility is developed for all types of organizations and is not limited to corporations and businesses. The seven key principles presented as roots of social responsibility align with the core of sustainability thinking. These are accountability, transparency, ethical behavior, respect for the interests of stakeholders, respect for the rule of law, respect for international standards of behavior, respect for human rights. Other disclosure-oriented sustainability models suggest that [28] the relationship between managers' incentives to disclose management earnings forecasts (MEF) and Global Reporting Initiative (GRI) sustainability reports; Two types of voluntary disclosures that are produced by managers to provide financial and/or non-financial information to interested parties.

As the antecedent determinants of these two disclosures overlap, but the related risks and strategic approaches differ, managers' decisions to disclose MEF and GRI sustainability

reports could be independent, cooperative, competitive, or even conflicting. While stakeholders want more high-quality information, managers compromise on the level of disclosure in practice. It is concluded that the recent trend of appeals by regulators, professionals and academics to improve standards in quantity and quality of voluntary disclosures for information users is growing.

3 Methodology

Considering the information collected from the sustainability reports of companies belonging to the hydrocarbon sector, two groups of variables were classified: one that corresponds to the measurement of the resources impacted by this sector in the environmental dimension and another economic variable that measures the performance and financial situation as evidenced in Fig. 1. The first thing that was analyzed was the possibility of a relationship between these two variables in the sense that the economic variables have effects on the environmental ones or the environmental ones on the economic ones.

After cleaning the database, it was decided to work with the years as if they were categories. Next, a principal components analysis was run with the purpose of selecting one or two factors that collect information from all these variables, to replicate the same with other variables and then cross them to determine if they are related. From this observation, their correlation was determined to proceed with the generation of an analysis model.

4 Results

When reviewing the first group of variables to determine their behavior over the last three years as shown in Fig. 1.

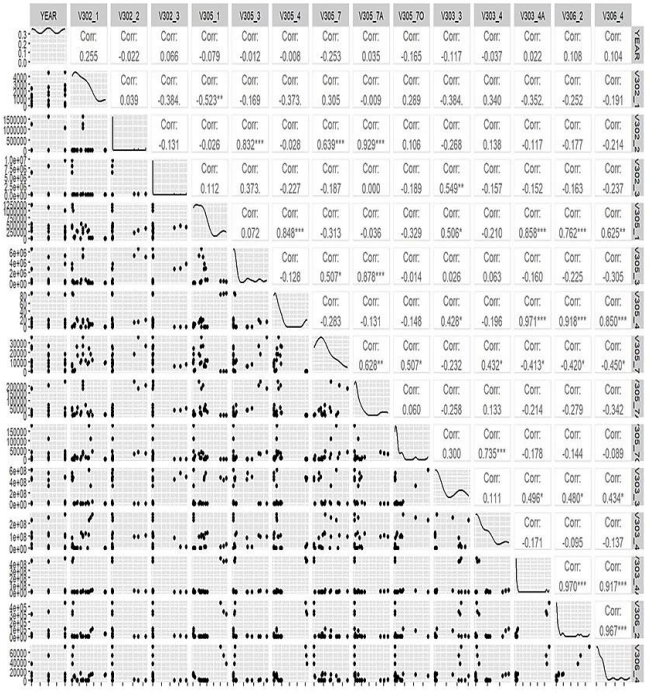

Figure 1. Correlation between the analysis variables
Source: Own elaboration based on the R program

Table 1
Correlation of variables in Figure 2

Variable	Correlation	Variable
305_7 Nitrogen Oxide	0.639	302_2 non-renewable consumption
305-7_A Sulfur Oxide	0.929	302_2 non-renewable consumption
305_7_A Sulfur Oxide	0.878	305_3 Other indirect emissions
305-7_A Sulfur Oxide	0.628	305_7 Nitrogen oxide
305_4 GHG emissions intensity	0.848	305_1 direct GHG emissions
305_4 GHG emissions intensity	0.850	303_4 Water spills
305_7_O Other significant GHG emissions	0.628	305_7 Nitrogen oxide
305_3. Other indirect GHG emissions	0.832	302_2 non-renewable consumption
303_4 A water consumption	0.971	306_2 waste disposal method
303_3 water extraction	0.549	302_3 energy intensity
306_2 waste disposal method	0.625	305_1 direct GHG emissions
306_2 waste disposal method	0.625	305_1 direct GHG emissions
306_2 waste disposal method	0.918	305_4 GHG emissions intensity
306_2 waste disposal method	0.970	303_4 A water consumption
306_2 waste disposal method	0.96	306_4 transportation of hazardous waste
303_4 Water spills	0.735	305_7_O Other significant GHG emissions

Source: self-made

As can be seen, Table 1 reflects that there is a marked correlation between the emission of greenhouse gases and the consumption of non-renewable energy, that is, to the extent that non-renewable resources are used, the impact at the GHG level is greater; Water consumption and extraction are

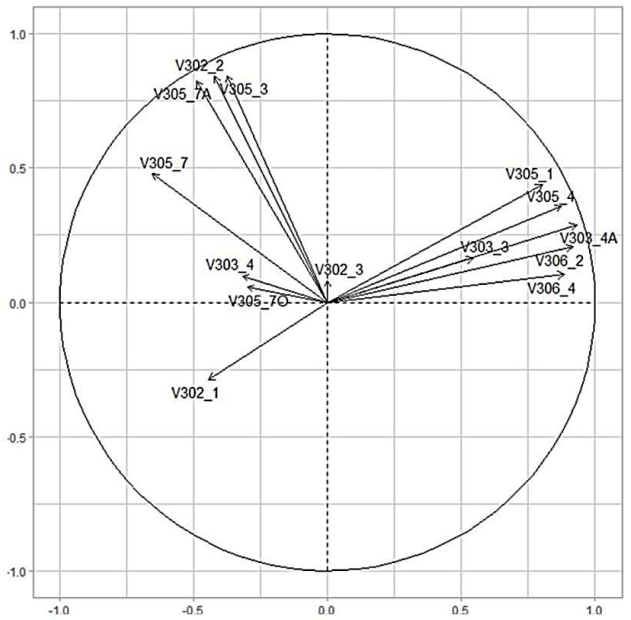

Figure 2. Graph of the variables
Source: Own elaboration based on the R program

correlated with energy intensity and the method of waste disposal and water landfills are correlated with significant GHG emissions, that is, to the extent that the hydrocarbon sector uses non-renewable resources in its productive process, an effect is generated in the increase of GHG.

Different groups of variables can be observed, in the upper right quadrant of the circle is the first group of variables made up of 305_1 Direct GHG emissions, 305_4 GHG emissions intensity, 303_4 A Water consumption, 303_3 Water extraction, 306_2 Waste method disposal and 306_4 transportation of hazardous waste.

The upper left quadrant marks a second group made up of the variables 302_2 Non-renewable consumption, 305_3 other direct emissions, 305_7A other sulfur emissions, 305_7 nitrogen oxide and the lower left quadrant of the circle, includes the variables of 302_1 renewable consumption, 305_7O Other significant GHG emissions, 302_3 energy intensity AND 303_4 water landfills.

The group made up of the variables in the upper right quadrant and the group in the lower left quadrant are inverse or their behavior is inverse. This can be explained from the correlation between variables described in Table 1 and that are grouped in the first group. of variables, their relationship is explained because in the production process of hydrocarbon extraction the use of non-renewable resources has an impact on the generation of GHG. This situation explains why this first group of variables is inverse to the third group that contains the renewable consumption variable. It could then be said that they are inverse or negative because the use of renewable resources would reduce the impact of GHGs, without eliminating them, consequently. It could then be other significant GHG emissions, in addition to the impact on energy intensity and the information related to water landfills as a disposal method reveals the limit of the organization at the management level between forms of disposal and inequitable environmental impacts. with environmental impacts and residual effects. In other words, the grouping of the variables of group 1 and three are inverse or could be said to have opposite behavior at the level of the impacts produced on the ecosystems.

The variables located in the upper left quadrant, or the second grouping of variables, are independent in relation to the other groups. This group includes 302_2 non-renewable consumption, 305_3 other indirect emissions, 305_7 sulfur oxide, and 305_7 nitrogen oxide. The correlation of these variables suggests that nitrogen oxide and sulfur are linked to the consumption of non-renewable resources, which in turn affects other indirect emissions of greenhouse gases. Therefore, the behavior of these variables operates independently from the others.

As can be seen in Fig. 3 when the entities are graphed, within the analysis, the behavior of the company GEOPARK and ECOPETROL are the metrics that provide the most information exposed in their integrated information reports. Although Ecopetrol's financial structure is much more robust than GEOPRK's, its impact on the environment in the production process is greater than that of the other entities in most of the metrics analyzed. This allows them to be easily identified in Fig. 3.

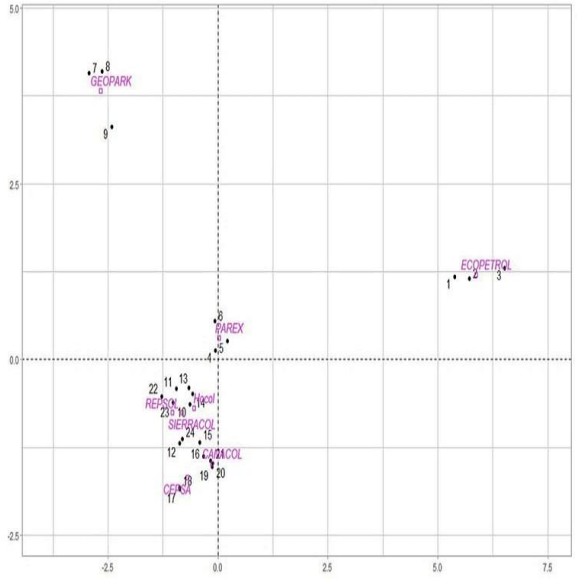

Figure 3. Classification by years of companies
Source: Own elaboration based on the R program

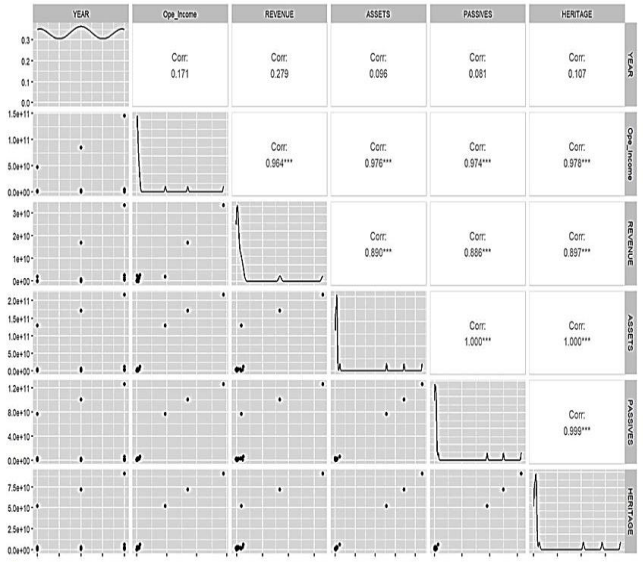

Figure 4. Analysis of economic variables based on reported financial information
Source: Own elaboration based on the R program

Fig. 4. shows how the operating profit is related to the other accounts of assets, liabilities and equity, this is explained by the fact that to the extent that the profit in the income statement increases, which depends on income, there is an increase in the net worth of the entity and the net worth at its disposal. This result is clear evidence of financial correlation between results and net worth, which allows us to observe permanent financial health in these companies in the hydrocarbons sector.

This explains their high relationship as evidenced in the following graph in Fig. 5:

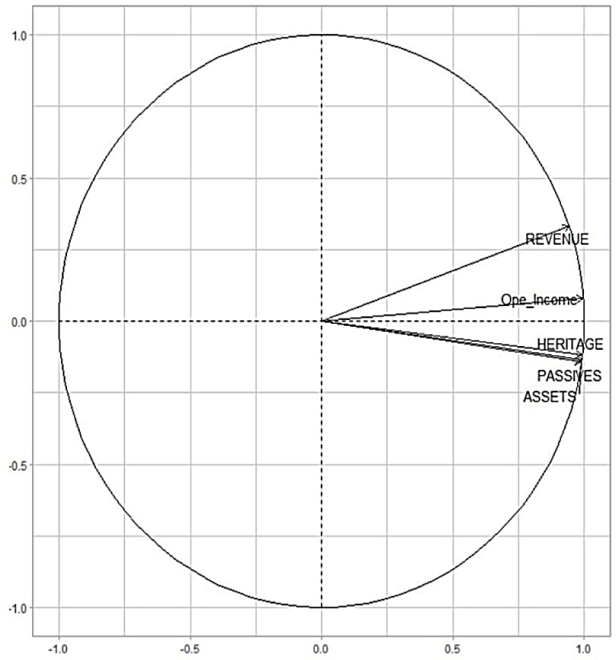

Figure 5. Relationship between the economic variables analyzed.
Source: Own elaboration based on the R program

The objective of the observation of the economic variables is the construction of a second factor called base two, which will be crossed with the base one variable, which was obtained from the analysis of the variables of the environmental dimension, previously referenced to identify if there is any degree of correlation between them. Fig. 6 shows that when crossing these variables, no correlation is observed between them.

Data: F1 and F2t = -0.013432, df = 22, p-value = 0.9894; alternative hypothesis: true correlation is not equal to 0; 95 percent confidence interval: -0.4057916, 0.4009963; sample estimates Cor - 0.002863672.

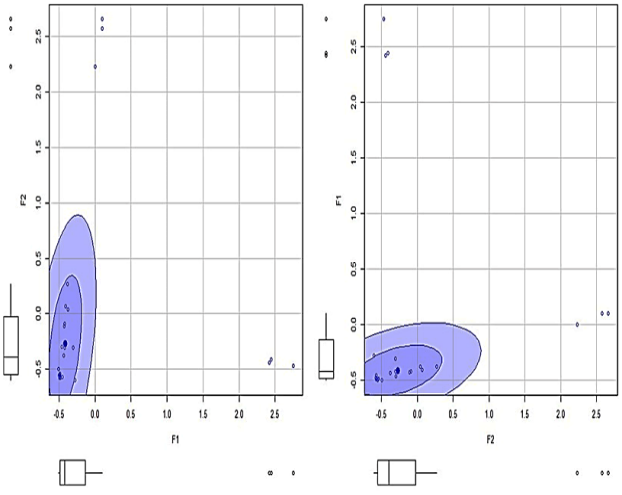

Figure 6. Graph of the factors obtained from the grouping of the variables.
Source: Own elaboration based on the R program

The results presented in Fig. 6 show that there is no correlation between economic and environmental variables. Proof of this is that the correlation index or Pearson's R is very close to zero 0.002863672 and this is demonstrated with the value of P which is equal to 0.9894. The null hypothesis posits that the correlation is zero, but in this case, the correlation differs from zero. In addition, the P value is below 0.05, the predetermined level of significance, indicating the rejection of the null hypothesis. Consequently, it was feasible to reject the claim that the correlation is zero.

Upon examination of the data without Ecopetrol, the absence of any discernible pattern or correlation remains evident.

5 Conclusions

After analyzing the behavior patterns of the variables, it is concluded that there is no pattern or correlation between the economic and environmental variables measured by each of the entities and revealed in the integrated information reports.

When studying the variables, it is found that the use of non-renewable resources and energy is related to the generation of greenhouse gases, the opposite situation when comparing group three of the variables that were inverse to group one of variables basically due to the weight of the variable renewable resources.

This situation could indicate that the mitigation of the impact on the environment produced by the exploitation of hydrocarbons could be mitigated if the use of renewable resources and energies is chosen.

For future work, it would be useful to work with the first group of variables that show correlation or relationships between them.

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Organizational culture and its implications for project management in an engineering consulting firm

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Abstract
This study examines the organizational culture of an engineering consulting firm and its impact on project management practices. The Organizational Culture Assessment Instrument (OCAI), based on the Competing Values Framework (CVF), was used to assess the current and desired cultural profiles, complemented by qualitative data on employee perceptions. A dominant Market culture was identified, focused on results and customer satisfaction. Recognizing the need for a stronger Clan culture, the study emphasizes improved communication, collaborative leadership, and interdisciplinary synergy to enhance project teamwork and knowledge sharing. Additionally, there was a significant desire for increased Adhocracy, highlighting the need for innovation and adaptability in response to dynamic project demands. The study provides recommendations to strengthen organizational culture and optimize project management.

Keywords: organizational culture; business performance; customer focus; human-centered approach; project management; service quality.

La cultura organizacional y sus implicaciones para la gestión de proyectos en una empresa de consultoría en ingeniería

Resumen
Este estudio examina la cultura organizacional de una firma de consultoría en ingeniería y su impacto en la gestión de proyectos. Se utilizó el Instrumento de Evaluación de la Cultura Organizacional (OCAI), basado en el Marco de Valores Competitivos (CVF), para evaluar los perfiles culturales actuales y deseados, complementado con datos cualitativos sobre las percepciones de los colaboradores. Se identificó una cultura predominante de Mercado, enfocada en los resultados y la satisfacción del cliente. Reconociendo la necesidad de fortalecer la cultura Clan, el estudio destaca la importancia de mejorar la comunicación, el liderazgo colaborativo y la sinergia interdisciplinaria para potenciar el trabajo en equipo y el intercambio de conocimientos. Además, se observó la necesidad de incrementar la cultura de Adhocracia, subrayando la necesidad de innovación y adaptabilidad frente a demandas dinámicas de los proyectos. El estudio ofrece recomendaciones para fortalecer la cultura organizacional y optimizar la gestión de proyectos.

Palabras clave: cultura organizacional; rendimiento organizacional; orientación al cliente; orientación en las personas; gestión de proyectos; calidad en el servicio.

1 Introduction

Organizational culture, a complex interplay of shared values, beliefs, and behavioral norms [1], has emerged as a determining factor in shaping organizational effectiveness and competitiveness [2]. A well-developed organizational culture fosters collaboration, innovation, and client-centricity [3], contributing significantly to successful project delivery and client satisfaction. Furthermore, it enables organizations to adapt and respond effectively to the dynamic demands of the modern business environment, while simultaneously prioritizing employee well-being and professional growth. Cultivating and refining such a culture requires a human-centered approach, encompassing a thorough diagnosis of existing cultural

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structures, identification of developmental opportunities, and strategic implementation of interventions designed to reinforce desired values and empower organizational members [4].

Project management, inherently complex, demands the intricate coordination of resources and the integration of diverse perspectives [5]. Organizational culture exerts a considerable influence on project management processes, shaping leadership styles, communication practices, teamwork dynamics, and client interactions [6-10]. It also influences the choice and implementation of project management methodologies [11]. Moreover, a strong emphasis on quality and human development within the project subculture has been linked to improved and client satisfaction [12]. Empirical evidence further supports the importance of integrating human resource practices with quality management within a supportive cultural context to achieve sustainable organizational performance [13]. Organizational culture also plays a vital role in navigating technological transformations, particularly in the context of Industry 4.0, facilitating the implementation of advanced quality management approaches while balancing technological advancement with human-centered considerations [14].

Despite extensive research on the influence of culture on project management across various sectors [15-17], empirical studies specifically focusing on engineering consulting firms remain limited. This sector, distinguished by a highly specialized workforce, inherent project complexity, and a constant drive for innovation, necessitates a contextualized analysis of the relationship between organizational culture and project management.

This work addresses this gap by investigating the relationship between organizational culture, analyzed through the Competing Values Framework (CVF) [18], and its impact on project management within a Colombian engineering consulting firm. The CVF, a widely adopted framework for assessing and categorizing organizational cultures, posits four distinct cultural archetypes: Clan, Adhocracy, Hierarchy, and Market. Each archetype reflects a unique set of values, priorities, and behavioral norms. Clan cultures prioritize collaboration, teamwork, and employee development; Adhocracy cultures emphasize innovation, flexibility, and risk-taking; Hierarchy cultures focus on control, efficiency, and adherence to established procedures; and Market cultures prioritize competition, results orientation, and customer satisfaction.

While the CVF has been employed to examine organizational culture across a range of contexts [19-21], its utilization in the domain of engineering project management remains constrained. Further exploration is required to ascertain the specific influence of these cultural archetypes on project success in this technically demanding field. Furthermore, as international projects become increasingly prevalent, research is required to comprehend the manner in which organizational culture interacts within cross-cultural settings, particularly in the context of engineering. This will facilitate the navigation of these complexities and enhance project outcomes [22-23].

The engineering consulting firm in question has undergone a period of rapid growth and diversification across multiple engineering domains (oil & gas, energy, infrastructure), and provides a compelling case study for exploring the complexities of the culture-project management dynamic. Employing a mixed-methods approach, combining quantitative data from the Organizational Culture Assessment Instrument (OCAI) [18] with qualitative insights gleaned from employee interviews, this study offers a perspective on how organizational culture influences project management effectiveness in a rapidly evolving engineering consulting environment. The findings offer valuable theoretical and practical implications for engineering consulting firms seeking to optimize project outcomes through a deeper understanding and strategic management of their organizational culture.

The remainder of this paper is organized as follows. Section 2 details the research methodology employed. Section 3 presents the findings from both the quantitative and qualitative data analysis. Section 4 discusses the implications of these findings for project management within the context of the engineering consulting industry. Finally, Section 5 summarizes the conclusions and recommendations for future research and practice.

2 Methodology

This case study employed a mixed-methods sequential explanatory design [24], integrating quantitative and qualitative data to investigate the relationship between organizational culture and project management effectiveness within a Colombian engineering consulting firm. This sequential approach prioritized quantitative data collection using the Organizational Culture Assessment Instrument (OCAI) [18], followed by qualitative data collection to explicate the quantitative findings.

The OCAI, adapted and validated for the Spanish language context, served as the primary quantitative instrument. This instrument, grounded in the Competing Values Framework (CVF) [18], assesses organizational culture along four dimensions: Clan, Adhocracy, Market, and Hierarchy. Data were collected in April 2024 via two online surveys administered via Microsoft Forms: "Current Culture: Our Culture" (n=338, 60.5% response rate from 558 eligible employees) and "Desired Culture: What culture do we want to cultivate?" (n=290, 60.3% response rate from 481 eligible employees; the difference in sample size reflects normal workforce fluctuation). Each survey employed a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree).

Descriptive statistics were computed for each cultural dimension. Cronbach's alpha was utilized to assess the internal consistency reliability of the OCAI scales (Table 1).

Table 1.
Cronbach's Alpha reliability analysis: OCAI results

Archetype	Reliability coefficient (Cronbach's Alpha)	
	Current Culture	Desired Culture
Market	0.878	0.811
Clan	0.878	0.899
Adhocracy	0.843	0.891
Hierarchy	0.811	0.729

Source: Own elaboration

Table 2.
Analytical emergent themes

Theme	Description	Categories
Communication & Collaboration	Examines how information flows, is shared, and affects team coordination and project outcomes, influencing collaboration efficiency and problem-solving capabilities.	Clan, Hierarchy
Leadership & Empowerment	Focuses on leadership styles, the support leaders provide to teams, and the autonomy and decision-making power granted to employees, impacting team engagement and project success.	Clan, Adhocracy
Innovation & Adaptability	Assesses the organization's approach to integrating new ideas, technologies, and processes, as well as its capacity to adapt to changing project requirements and external factors.	Adhocracy
Employee Well-being	Explores factors influencing employee motivation, job satisfaction, work-life balance, and overall well-being within the project context and organizational environment.	Clan, Market
Customer Orientation	Investigates how client needs and expectations are understood, addressed, and managed throughout the project lifecycle, influencing client satisfaction and project alignment.	Market
Process & Efficiency	Analyzes the effectiveness of organizational processes, balancing standardization and flexibility, and their impact on project execution, cost-efficiency, and timeline management.	Hierarchy, Adhocracy

Source: Own elaboration

All cultural dimensions exhibited acceptable internal consistency, with Cronbach's alpha coefficients ranging from 0.729 to 0.901; this value remains within the conventionally accepted threshold of 0.7 for acceptable internal consistency [25]. The Market and Clan dimensions demonstrated particularly strong reliability ($\alpha = 0.878$ and $\alpha = 0.901$ for Market, current and desired, respectively; $\alpha = 0.878$ and $\alpha = 0.899$ for Clan, current and desired, respectively).

Both OCAI surveys included open-ended questions designed to elicit employees' perceptions of organizational culture and its impact on project management. These qualitative comments provided substantive contextual insights that complemented the quantitative data. Thematic analysis, following the framework established by Braun and Clarke (2006), was employed in order to analyze the qualitative data [26] was used to analyze the qualitative data. An iterative process was used to first identify meaningful segments of text indicative of key concepts and patterns related to organizational culture and project management.

Initial coding was primarily inductive, derived directly from the data, followed by deductive coding to align with the OCAI dimensions and pre-defined project management-related aspects. The codes were grouped into potential themes based on similarities, patterns, and relationships, and refined. This process facilitated the identification of emergent themes related to project management, including communication and collaboration, leadership and empowerment, innovation and adaptability, customer orientation, employee well-being, and process and efficiency (Table 2).

The findings from the quantitative (OCAI) and qualitative thematic analysis phases were integrated to provide a comprehensive understanding of the organizational culture and its influence on project management. Qualitative data were used to illuminate and contextualize the quantitative results, offering insights into the mechanisms through which cultural dimensions affect project management practices and outcomes.

1 Results

This section presents the findings from the research, integrating quantitative data from the Organizational Culture Assessment Instrument (OCAI) based on the Competing Values Framework (CVF) [18] and qualitative insights derived from employee feedback. The analysis focuses on the implications of the identified cultural characteristics for project management within the Colombian engineering consulting firm.

1.1 Comparative OCAI results and project management implications

The organizational culture profiles, both current and desired, are illustrated in Fig. 1 using the Organizational Culture Assessment Instrument (OCAI). The radar chart depicts the strength of four cultural types: Clan, Adhocracy, Market, and Hierarchy; the solid blue line represents the current cultural profile, while the dashed orange line represents the desired cultural profile. The results reveal a dominant Market culture in both the current (4.01) and desired (3.99) states, as further detailed in Table 3. This reflects the firm's emphasis on competitiveness, client focus, and achieving measurable results, aligning with the firm's strategic focus on market competitiveness and its ISO 9001-based quality management system. These findings resonate with Willar et al. [27], who observed similar patterns in organizations prioritizing market performance. In the context of project management, this translates into a strong emphasis on meeting deadlines, budgetary adherence, and fulfilling quality requirements.

The persistent Market culture profile reflects a strategic organizational disposition characterized by external competitive dynamics and measurable performance outcomes. This cultural configuration is significantly contextualized by the national economic environment and the organization's strategic imperative of exploring and capitalizing on emerging market opportunities. The convergence between current and desired Market culture scores suggests a high degree of organizational alignment with existing market-oriented practices, indicating both strategic consistency and an understanding of competitive positioning within the engineering consulting sector.

Table 3.
Current and desired organizational culture profiles: OCAI results

Archetype	Current Culture	Desired Culture
Market	4.013	3.992
Clan	3.919	3.787
Adhocracy	3.789	3.687
Hierarchy	3.893	3.798

Source: Own elaboration

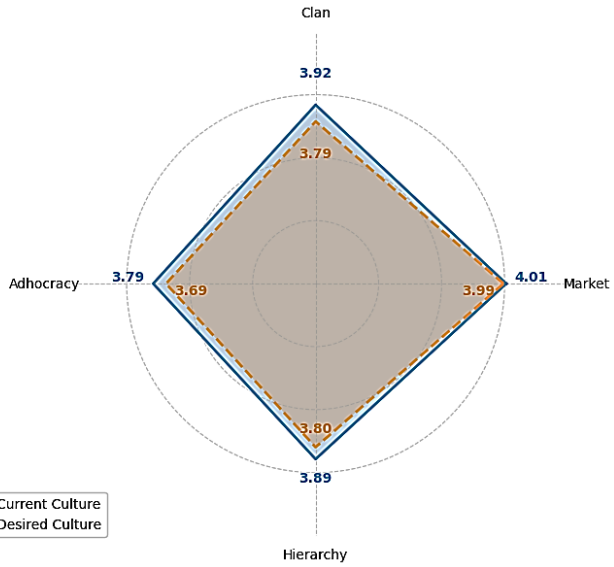

Figure 1. Organizational culture profiles: current and desired
Source: Own elaboration

While the Market culture dominates, the current state also exhibits strong Clan (3.919) and Hierarchy (3.893) characteristics. This blend suggests a value for collaboration, teamwork, and structured processes, alongside the market focus. However, the qualitative data indicates the presence of a potential issue. Although employees appreciate teamwork, feedback highlights communication gaps and a lack of interdisciplinary synergy, hindering project efficiency and potentially impacting service quality. This disconnect aligns with previous research indicating that transparency and mutual understanding don't automatically translate into high levels of trust and collaboration [28]. The strong Hierarchy component, while providing structure and stability, may also contribute to resistance to change and hinder the development of a more adaptive and innovative culture.

The desired culture, while retaining the Market focus, reveals a desire for stronger Hierarchy and Clan components. This suggests a need for more clearly defined organizational structures, decision-making processes, and leadership that fosters both employee belonging and adherence to established procedures. This resonates with research demonstrating that clan culture significantly enhances project performance and business outcomes by cultivating a cohesive, high-performing work environment that drives project success metrics while simultaneously generating cost efficiencies and competitive advantages [29]. Furthermore, it underscores the significance of harmonizing market-driven competitiveness with a nurturing and collaborative internal environment. Furthermore, it underscores the significance of harmonizing market-driven competitiveness with a nurturing and collaborative internal environment.

The Adhocracy scores for both the current (3.789) and desired (3.687) states suggest a need for greater attention to innovation, flexibility, and risk-taking. This finding is further substantiated by qualitative feedback, which emphasizes the necessity of increased investment in innovation and training. This suggests a potential limitation in adaptability. In the dynamic engineering consulting sector, the capacity for adaptability, innovation, and the ability to generate and implement new ideas for sustaining long-term competitiveness, especially when integrating agile methodologies [30-31].

The gaps between current and desired scores for Market and Hierarchy suggest relative satisfaction with the current levels of competitiveness and structure. However, the gaps observed for Clan and Adhocracy emphasize the need for interventions targeting communication, collaboration, and innovation. This supports Amaro's [3] assertion that cultural factors must be addressed before implementing process improvements. Furthermore, the qualitative data underscores the role of employee well-being in cultivating a positive and productive work environment, which in turn affects service quality [32]. Consequently, this reinforces the notion that assessing organizational culture is a step in developing targeted strategies for enhancing not only project performance but also overall organizational effectiveness, particularly within the context of professional services firms like engineering consulting, where human capital is paramount for project management.

3.2 Qualitative feedback and project management implications

The thematic analysis of the qualitative data, following Braun and Clarke's [26] methodology, revealed six interrelated themes that guided the relationship between organizational culture and project management. These themes emerged through an iterative coding process that combined inductive analysis of employee narratives with deductive alignment to OCAI dimensions. Table 4 presents the primary coding scheme employed for the thematic analysis.

The analysis revealed a notable dichotomy between organizational strengths and areas for development, with significant implications for project management practices. While employees acknowledged strong collaborative dynamics within immediate teams, as evidenced by statements such as "there is a real collective spirit of teamwork," significant challenges were identified in cross-functional communication. Interview data revealed particular concerns about "interdisciplinary and interdepartmental coordination". This communication gap has a significant impact on project schedule adherence and deliverable

Table 4.
Thematic inductive coding scheme

Theme	Primary codes	Implications for project management
Communication & Collaboration	team interaction; information flow; Interdisciplinary dynamics; communication patterns; meeting structures; knowledge sharing	Effective teamwork, knowledge transfer processes, and timely problem-solving
Leadership & Empowerment	decision-making patterns; authority dynamics; team guidance; training needs; management approaches; leadership skills	Project team autonomy, decision-making processes and responsiveness to change
Innovation & Adaptability	technological integration; change response; resource allocation; methodological approaches; innovation practices; adaptation processes	Capacity for project adaptation, technical advancement, and develop creative solutions
Employee Well-being	work flexibility; time management; communication; job stability; work environment; performance	Team performance and project effectiveness
Customer Orientation	service quality; timeline management; client interaction; quality standards; relations; feedback; integration	Project alignment and stakeholder satisfaction
Process & Efficiency	workflow patterns; resource management; process standardization; operational flexibility; task distribution; mechanisms	Standardization needs, project agility and responsiveness to change

Source: Own elaboration

quality, especially during periods of organizational uncertainty. The findings indicate a need for comprehensive review and optimization of project management processes, including the implementation of methodologies and tools that promote both efficiency and quality.

The analysis revealed a complex leadership landscape characterized by contrasting experiences. The current clan culture score (3.919) suggests a collaborative environment, but qualitative data suggests inconsistent leadership practices. While some employees praised leadership's focus on human capital, others expressed concerns about objectivity and communication style. Some complaints about management and calls for more leadership training suggest a disconnect between desired participative leadership and current practices. This divergence particularly affects project team autonomy and decision-making efficiency, highlighting the need for more skilled and empathetic leadership approaches.

The relatively lower Adhocracy scores (current: 3.789, desired: 3.687) are consistent with employee feedback indicating limited innovation capacity. In particular, participants cited a lack of innovation due to "no alternatives being presented" and resistance to technological advances. This conservative approach, while potentially reducing risk, hinders the organization's ability to adapt to evolving project needs, although balanced against the need for operational stability. Employees emphasized the need for increased investment in innovation and the development of a more supportive culture for experimentation and technology adoption.

The analysis revealed a nuanced perspective on employee well-being, with flexible work arrangements emerging as a positive factor and source of motivation and performance. However, concerns about workload management and work-life balance were prevalent, with employees reporting longer working hours. Also, employees emphasize the need for training opportunities that support professional growth and service quality enhancement. The tension between market-driven performance expectations (OCAI score: 4.013) and clan-driven employee support (3.919) manifested itself in project resource allocation and scheduling challenges. Belonging to the company emerged as a source of pride, although this positive aspect is sometimes overshadowed by concerns about job security and changing working conditions.

Market culture orientation (current: 4.013, desired: 3.992) reflects a strong customer focus, as evidenced by comments emphasizing the quality of deliverables. However, qualitative data suggests a need for more balanced client relationships, with employees noting the importance of negotiating realistic timelines. While there is a clear awareness of the importance of client focus to organizational success, employees perceive a gap between this awareness and concrete actions, suggesting an opportunity to improve project success through more collaborative client partnerships while maintaining delivery excellence.

The interplay between hierarchical (3.893) and adhocracy (3.789) values is clearly evident in the process-related feedback. Employees identified significant opportunities for efficiency improvement, particularly in the timeliness of deliverables. The data suggests that current processes, while structured, may not optimally support project execution, indicating a need for balanced standardization that maintains necessary flexibility.

These findings collectively suggest that while the organization demonstrates strengths in team-level collaboration and client orientation, significant opportunities exist to enhance project management effectiveness through improved cross-functional communication, leadership development, and process optimization. The analysis reveals particular tension between maintaining established procedures and fostering innovation, a challenge that directly impacts project execution and outcomes. Furthermore, the emphasis on client orientation and job security underscores the interconnected nature of employee satisfaction, project success, and client satisfaction in the organizational ecosystem.

2 Discussion

This research reveals a complex interplay between organizational culture and project management performance. Contrary to the traditional view of inherent contradiction between market orientation and clan values [33], our findings suggest a more nuanced relationship. The findings show that a strong market orientation is complemented by a significant presence of clan characteristics, demonstrating a

simultaneous emphasis on client satisfaction and team collaboration. This aligns with recent studies highlighting the symbiotic relationship between internal collaboration and external performance in project-based organizations [34]. However, the effectiveness of this combination hinges on its translation into concrete project management practices.

A significant gap exists between desired clan values and actual communication practices. This misalignment reinforces Aubry's argument regarding the challenges of cultural transformation in project-based organizations. Our results indicate a complex interplay between formal processes and informal cultural dynamics. This tension is particularly evident between hierarchical efficiency and adhocratic innovation, where formal structures both enable and constrain project performance. The Adhocracy score presents a paradox: while literature emphasizes innovation and adaptability [30,31,35], our findings reveal a resistance to these pressures in favor of stability. This extends the work of Durana et al. [14], showing how a strong quality culture can inhibit innovation when coupled with hierarchical control, mirroring a possible tension between innovation and existing culture. This resistance may limit adaptability to evolving project requirements and technological advancements.

Furthermore, our study highlights employee well-being as a mediating factor between cultural orientation and project performance, a relationship under-explored in prior research. Well-being is not merely a cultural outcome [36, 37], but an active mechanism through which culture influences project success, particularly in knowledge-intensive firms. The desire for enhanced hierarchical structure while maintaining flexibility contributes to the ambidexterity debate in project-based organizations. Our findings suggest that structure and flexibility can be complementary when supported by appropriate cultural values, extending current theory by demonstrating how standardization and adaptation can coexist through cultural alignment. Finally, evidence of concerns regarding job security and the impact of certain company policies underscores the need to address these issues to foster a supportive and positive work environment [4,32].

These cultural traits have direct implications for project management processes. For instance, while quantitative data revealed a strong emphasis on meeting deadlines and budget constraints (Market), reflected in high achievement orientation scores, qualitative interview data suggested this focus sometimes compromised comprehensive risk assessment and stakeholder engagement. Project managers described instances where tight deadlines led teams to bypass essential planning steps, causing unforeseen issues during execution. This highlights the tension between the Market culture's drive for efficiency and the need for more collaborative planning practices characteristic of a Clan culture. This tension also manifested during project execution. While the Market culture's focus on efficiency resulted in accelerated timelines (supported by quantitative performance data), qualitative feedback revealed instances where this rapid pace compromised quality and adaptability. One team member noted, "We're so focused on hitting deadlines that we sometimes rush through critical testing phases." Strengthening Clan-oriented characteristics, such as teamwork and knowledge sharing, could facilitate more robust and adaptable execution strategies.

Moreover, the observed resistance to adhocracy, despite its potential benefits for innovation, likely contributes to the difficulties adapting to unexpected project changes. Regarding communication, quantitative data indicated a preference for formalized channels and hierarchical reporting (Market), yet qualitative interviews revealed that this often-created communication bottlenecks and a lack of transparency. Employees expressed frustration with limited opportunities for open dialogue and feedback, with one noting, "Information flows down, but rarely up." Cultivating Clan-oriented communication practices could significantly improve information flow and collaboration. Finally, while the Market culture fostered individual accountability (reflected in positive performance data), qualitative feedback suggested it sometimes created a competitive environment that undermined team cohesion. Integrating Clan and Adhocracy principles, perhaps through cross-functional teams and knowledge-sharing initiatives, could foster a more supportive and collaborative atmosphere.

Based on these findings, a series of strategic recommendations have been formulated to enhance project management effectiveness through cultural alignment. Primarily, the implementation of formalized communication protocols, encompassing regular interdisciplinary meetings and the utilization of collaborative platforms, has the potential to address communication gaps and foster knowledge sharing. Concurrently, leadership development programs must prioritize empowering project teams, establishing clear roles and responsibilities, effective delegation of authority, and the implementation of robust feedback mechanisms to promote accountability and continuous improvement. Moreover, dedicated investment in innovation is imperative. This necessitates the establishment of dedicated innovation teams, the creation of platforms for idea generation and knowledge sharing, the provision of training opportunities in new technologies, and the fostering of a culture that actively encourages risk-taking, as suggested [38-39]. These initiatives directly address the observed resistance to innovation and the need for enhanced adaptability.

Finally, a comprehensive approach to employee well-being is required. This necessitates the implementation of well-being programs, the assurance of transparent communication regarding company policies, the establishment of structured recognition programs, and the offering of flexible work arrangements to foster a positive and supportive work environment. In addition to internal improvements, a targeted focus on client relationships is imperative. This entails client focus training for employees, active client involvement in all project stages, implementation of robust feedback mechanisms, and engagement in proactive relationship-building activities. Concurrently, a continuous review and optimization of existing processes, coupled with the implementation of continuous improvement methodologies, will facilitate the achievement of efficiency gains while balancing

standardization with the necessary flexibility to adapt to evolving project demands.

3 Conclusions

Organizational culture and its implications for project management within an engineering consulting firm were examined in this study. Findings reveal a significant relationship between the dominant Market culture, the desire for stronger Clan and Adhocracy elements, and the need to address employee well-being. While the firm's existing Market-driven culture aligns with its client-centric business model, it also presents project management challenges. An emphasis on competition and demonstrable results may prioritize deadlines and budgets at the expense of collaboration and innovation within project teams.

The expressed desire for a stronger Clan culture, with its focus on collaboration and employee development, suggests the value of interventions that promote teamwork and knowledge sharing within projects. An Adhocracy lens further reveals the importance of investments in innovation and training to cultivate a more adaptable and innovative project management approach capable of responding effectively to dynamic project demands.

Empirical evidence suggests successful cultural evolution requires the systematic integration of formalized structures with human-centric approaches. This integration manifests through interconnected dimensions, including communication architectures, leadership development, innovation capacity, workforce well-being, and process optimization. Synthesizing these dimensions indicates that organizational excellence and project management effectiveness transcend isolated interventions. Rather, a cohesive transformation of both technical and social subsystems is required, with an emphasis on balanced development between structural efficiency and human factors. Such an approach offers engineering consulting firms actionable pathways for cultural evolution while maintaining operational excellence.

The study contributes to existing literature by providing a contextualized analysis of the impact of organizational culture on project management within the engineering consulting sector. The mixed-methods approach provides a nuanced understanding of the cultural dynamics, highlighting the complexities of balancing competing cultural values within a project-based organization. Specifically, the research demonstrates that a strong market orientation can coexist with a desire for increased Clan and Adhocracy characteristics, provided that targeted interventions are implemented to address resulting tensions and foster a more integrated and balanced cultural profile.

Ultimately, a balanced cultural profile is essential for effective project management in engineering consulting. While a Market orientation contributes to efficiency, it must be counterbalanced by stronger Clan and Adhocracy elements to foster collaboration, adaptability, and open communication. These elements contribute directly to enhanced project outcomes. Future research should explore the longitudinal impact of the suggested interventions and investigate the mechanisms through which cultural change influences project success within this sector. Comparative studies across different firm sizes and specializations would be valuable. Incorporating employee well-being measures into future organizational culture assessments would offer a more holistic understanding of cultural influences on project performance.

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Influence of soft skills, and employee productivity, on organizational performance, a developing field: current state and relationship

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Abstract
Soft skills and employee productivity are key factors in sustainability and corporate performance in competitive and dynamic environments. The purpose of this article is to identify current findings related to soft skills, employee productivity and their relationship with organizational performance, and to propose a structural model that allows establishing this relationship. The results of some research conducted individually reveal positive and significant relationships in the proposed fields. Some skills found in the literature are communication, problem solving and decision making. To carry out this research, multiple research papers were collected between 2005 and 2024. A structural equation model was used as a way to propose a relationship between the aforementioned factors. This research theoretically demonstrated that soft skills and employee productivity contribute positively and significantly to organizational performance. Limitations may arise depending on the particularities of the industrial sector and the economic context. Since there is little research in the analyzed fields, this study contributes significantly to the identification of key variables.

Keywords: interpersonal skills; employee productivity; hard skills; organizational performance; project management; soft skills.

Influencia de las habilidades blandas y la productividad de los empleados en el desempeño organizacional, un campo en desarrollo: estado actual y relación

Resumen
Las habilidades blandas y la productividad de los empleados son factores clave en la sostenibilidad y en el desempeño corporativo en entornos competitivos y dinámicos. El propósito de este artículo es identificar los hallazgos actuales relacionados con las habilidades blandas, la productividad de los empleados y su relación con el desempeño organizacional, y proponer un modelo estructural que permita establecer esta relación. Los resultados de algunas investigaciones realizadas de forma individual revelan relaciones positivas y significativas en los campos propuestos. Algunas habilidades encontradas en la literatura son la comunicación, la resolución de problemas y la toma de decisiones. Para llevar a cabo esta investigación se recopilaron múltiples trabajos de investigación entre 2005 y 2024. Se utilizó un modelo de ecuaciones estructurales como forma de proponer una relación entre los factores antes mencionados. Esta investigación demostró teóricamente que las habilidades blandas y la productividad de los empleados contribuyen de forma positiva y significativa al desempeño organizacional. Pueden surgir limitaciones dependiendo de las particularidades del sector industrial y del contexto económico. Dado que existe poca investigación en los campos analizados, este estudio contribuye significativamente a la identificación de variables clave.

Palabras clave: habilidades interpersonales; productividad de los empleados; habilidades duras; desempeño organizacional; gestión de proyectos; habilidades blandas.

1 Introduction

Any organization, regardless of its size, economic sector and nature, is made up of people and its sustainability and competitiveness will depend mainly on the capabilities that this human talent possesses. Organizations generally hire new employees, particularly recent graduates, considering mainly their soft skills (SK) over their hard skills (HS) [1]. HBs are not only necessary for people who are studying, but are essential for employees in any type of work they perform

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[2,3]. Recent research has concluded that SK contribute significantly to success in the workplace [4-8], but not only as a means to improve performance as a collaborator but as Manullang states [9], SK are crucial for future leaders, and are desired by most employers in a competitive business environment [10]. In this way, the development and application of HB are configured as a requirement to remain in a competitive and dynamic business world [11]. However, soft and hard skills are not mutually exclusive concepts, since according to several investigations [12,13,1], soft skills facilitate the application of hard skills, thus changing the traditional business vision, now considering workers as an integral key element, not only for their ability to carry out a certain activity, but in particular for their competencies [1]. Consequently, HB and HD development are complementary, and some employers even prefer soft skills development over technical skills development when it comes to performing globally [13].

Soft skills (SK) can be defined as a set of qualities, habits, personality traits, attitudes and social qualities that are necessary both in everyday life and for job performance [14] [15]. A more recent definition given by Cimatti [1] states that soft skills are those competencies not connected to a specific task but dominant in all positions since they focus on how individuals involved in an organization relate to each other, therefore, they can be considered as a group of personality traits, accepted by society [16]. The necessity of soft skills creates a demand for employees who possess an appropriate set of skills, thereby constituting a noteworthy challenge for individuals and organizations operating in novel and evolving circumstances [17]. The existence and need for any social interaction in society and organizations, even in conditions with intense use of advanced technologies and human machine interactions, calls for soft skills [18]. In summary, soft skills are a set of socio-emotional capabilities and abilities that people use in interactions and are crucial to achieving personal and work success [19].

Employee Productivity can be defined as time spent actively by employees on tasks that require execution and production [20]. Similarly, Coker (2011) [21] defined employee productivity "as the level of employees' performance in relation to attendance, work quality, the capacity of performance and personal factors". According to [22] employee productivity indicates the extent to which the adoption of technology minimises the time and effort required to complete a specific work. Employee productivity is a key factor for organizations and employees and one of the most important objectives for several firms has been to improve employee productivity [20]. High levels of employee productivity generate greater profitability and competitive advantages because production costs are reduced and, on the other hand, product quality is improved [23,24]. Therefore, organizations face an increasing need to focus on value creating practices to foster trust to improve employee productivity [25]. Business development is necessary to be able to achieve a sustainable advantage over time. Therefore, organizations must encourage the increase in the productivity of their employees in a gradual manner. Previous studies have discussed the factors that affect employee productivity from the individual aspects, leadership style and management system in the company [26].

Despite the scenarios described, according to Suan [10], there is a problem that arises because managers and executives from various companies and industries still do not fully recognize the importance of training in social skills for employee performance; some managers even have misconceptions about the very concept of soft or interpersonal skills. In Latin America and the Caribbean, a significant proportion of companies' report having difficulty finding suitably qualified workers with the necessary skills for the job [19].

In Latin America and the Caribbean, a significant proportion of companies' report having difficulty finding suitably qualified workers with the skills necessary for the job [19]. In this regard, various organizations mobilize significant resources in the implementation of training in hard skills, that is, technical skills, leaving aside the development of HB, which are as necessary and important as hard skills for adequate organizational performance. Consequently, excessive reliance on technical and management skills at the expense of human or interpersonal skills that are considered essential for the success of a company's management, can jeopardize the company's mission in the long term [19]. In research conducted by Maniscalco [14] it was determined that several people recognize the importance of SK´s, but are not able to identify particular SK´s. Gaps between the skills employers require and what employees possess at the time of being selected for a job can entail both direct costs for companies, such as higher costs of recruitment processes and the need to train employees, and indirect costs due to higher staff turnover and lower levels of innovation [27].

The concept of organizational performance, which refers to strategic planning, operations, finance, legal and organizational developments. Several researchers relate organizational performance to financial performance, which involves budgets, assets, operations, products, services and markets [28]. However, organizational performance is a multidimensional construct that cannot be assessed only from a financial perspective but also from a non-financial perspective [29,30]. Organizational performance refers to the result obtained by an organization after carrying out its strategic activities [31], and the effectiveness with which an organization achieves its goals and objectives [32]. Three critical characteristics of organizational performance can be identified: efficiency, quality, and operations. Efficiency is the ability of an organization to achieve its objectives using the least number of resources possible. In other words, how effectively an organization uses its resources (time, money, and labor) to achieve its objectives. Quality refers to delivering the goods or services required by external or internal customers in the requested conditions. Through increased efficiency, organizations can generate cost savings, increased productivity, and profitability [33]. This research is unique in the literature on organizational performance as it involves the analysis of human factors analyzed at the same time in a structural model. Although there are various

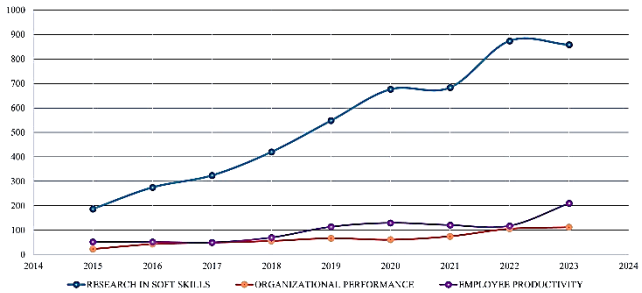

Figure 1. Data obtained from Scopus and adapted for this research.
Source: authors

investigations that analyze organizational performance, there is no evidence of research that integrates soft skills and employee productivity as latent variables, breaking down their key indicator variables.

Evidence extracted from the Scopus database indicates a growing research interest in the fields of knowledge related to this research. The research trend in these fields is illustrated in the Fig. 1:

From Fig. 1 it can be established that scientific research carried out in the fields analyzed between the years 2015 and 2023 has shown an increasing trend, which suggests a constant interest in these fields of knowledge; however, within the fields analyzed, research on soft skills presents the greatest amount of research.

This research, in its first phase, aims to propose a structural model that determines the influence of soft skills and employee productivity on organizational performance, through a literature review in order to generate a framework that clarifies the gaps identified in the problem raised. Therefore, the research addresses the following hypotheses:

H1: There is a positive and significant influence between soft skills and organizational performance

H2: There is a positive and significant influence between employee productivity and organizational performance.

2 Literature review

2.1 Soft Skills

Soft skills are socio-emotional capabilities and abilities that people use in their interactions and are crucial to achieving personal and professional success, and necessary to exercise leadership in teams, and are considered fundamental for professional development [34]. These skills are non-technical and do not depend on abstract reasoning, involving interpersonal and intrapersonal skills to facilitate successful performance in specific social contexts, and they are skills that increase competitiveness [35,18].

According to [36],soft skills refer to positive attributes, competencies, abilities, personality traits, and behaviors other than technical knowledge. They are also known as transferable skills that complement hard, academic, or technical skills. They are considered critical to career success, especially in the business field, and are more important than technical skills in terms of job success. Soft skills are commonly recognized as essential components of the skill set required for future employment [17].

According to a study conducted by [3], it was determined that variables associated with soft skills such as: communication, teamwork, learning capacity, and attitude, have a significant and positive effect on the employability of professionals. Another study conducted by Sudarso, 2022 showed that leadership also has a positive and significant effect on performance.

2.2 Employee productivity

Employee productivity refers to a measure of how much an employee produces in a specific period [37]. This type of productivity establishes the ability to accomplish certain tasks according to predetermined or specified standards of accuracy, completeness, cost, and speed [38]. And it has frequently been used to evaluate the efficiency of the worker taking into account the resources and costs associated with the fulfillment of tasks [39]; Thus, understanding factors that influence employee productivity is vital in enhancing firms' efficiency. Another definition determined by [40] , states that employee productivity refers to the efficiency with which workers generate value for the company. It is defined as the relationship between profit before taxes and interest and the total number of employees in the company. It is not surprising that extant literature considers employee productivity a critical

component of a firm's success and performance [37]. According to [41], one of the most important objectives for many companies has been to improve employee productivity. This is because greater productivity offers different advantages to companies and workers, such as economic expansion, increased profits, and this, in conclusion, translates into organizational performance. The research analyzed in this study shows employee productivity as a dependent variable (Y), in this research, a value proposition consists of taking employee productivity as an independent variable (X).

2.3 Organizational performance

Performance describes the achievement of program implementation or activity policies in realizing the goals, objectives, vision, and mission outlined in an organization's strategic planning [42]. From a global perspective, and according to [43,44], organizational performance refers to a concept that measures a company's position in the market and its ability to meet the needs of its stakeholders. From a more operational point of view, this type of performance can be understood as the degree to which the operation meets performance objectives, and satisfies customer needs [45].

Traditionally, organizational performance is usually measured under a basically financial interpretation, that is, financial ratios such as profitability, return on assets (ROA), return on investments (ROI), and return on equity (ROE); however, it is a construct that cannot be assessed only from a financial perspective but also from a nonfinancial perspective [29,30]

Organizational performance reflects the ability of an organization to fulfill its shareholders' desires and survive in

the market [43]. According to [46], organizational performance is the result of the actions or activities that members of organizations carry out to measure how well an organization has achieved its objectives, therefore, organizational performance is the ability of the organization to achieve its objectives. Organizational performance refers to the efficient acquisition and use of various corporate resources to successfully implement strategies to achieve organizational goals and objectives [47,48]. Similarly, this type of performance is generally considered as the degree to which an organization achieves its desired goals and objectives, such as increasing revenue, profit, market share, return on investment, customer satisfaction, and employee productivity [49].

3 Methodology

This study explores the relationship between soft skills, employee productivity, and organizational performance, starting from a literature review and subsequently determining a structural relational model (SEM). This type of research is descriptive, using data and evidence from research articles extracted from databases such as: EBSCOHOST, EMERALD, SCIENCEDIRECT and SCOPUS. The articles included in this research were taken in the interval between the years 2005 to 2023. A population of 238 research articles was collected, which show evidence of soft skills, employee productivity, and organizational performance in different countries and economic sectors was analyzed.

To determine the structural model to be proposed, the indicator variables of the proposed latent variables were identified. To arrive at these definitions, the following procedure was followed:

The methodological design used is illustrated below:

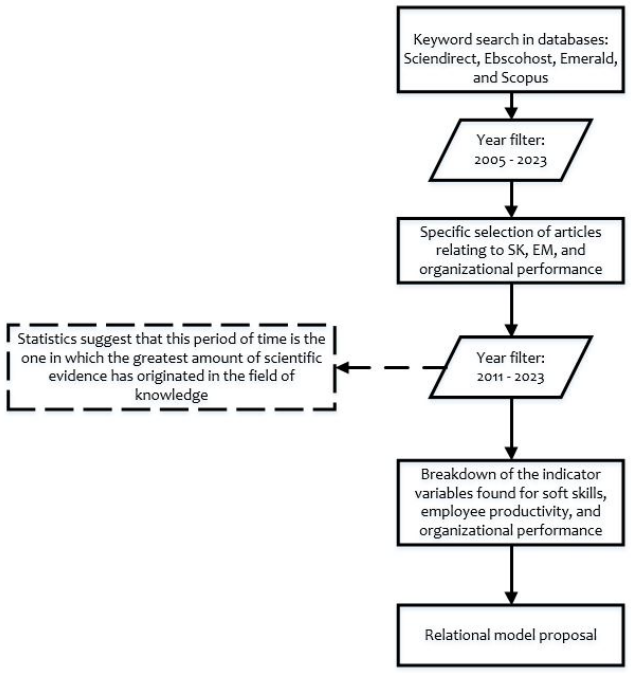

Figure 2. Proposed methodology.
Source: Made by the authors

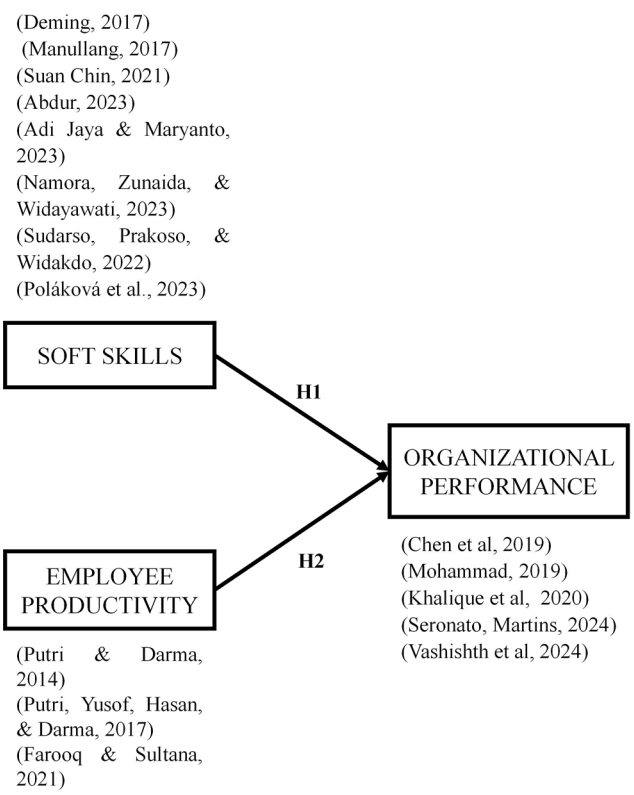

Figure 3. Theoretical framework.
Source: Made by the authors

4 Theorical framework

The theoretical model to be proposed in order to establish the relationship between the established variables is the following:

Fig. 3, which presents the theoretical model, illustrates the dependent latent variable (Organizational performance), and two independent latent variables (soft skills and employee productivity), and to determine each of the observable variables, the authors that accompany each variable were followed.

5 Results

Although there are numerous studies carried out in the field of soft skills, at the level of scientific research, there are few studies carried out on the influence of soft skills on organizational performance. Some research such as that carried out by [50] has determined a relationship between soft and hard skills in employee performance. The available evidence from research carried out reveals that employee performance has been worked on as an endogenous latent variable, however, in this research, it has been included as an exogenous latent variable, in order to determine the possible observable variables that affect organizational performance.

Research carried out by [51] determined that soft skills are a critical success factor for the employability of workers, and these skills remain irreplaceable by robots, and are necessary to thrive in a future characterized by technological

advancements [17]. According to [52], there is a positive and significant effect of soft skills such as workability, discipline, and communication on leadership resilience and organizational performance. In a study conducted by [53], in the Kenyan Department of Horticulture, it was concluded that employee communication significantly determines organizational performance.

Based on the different scientific evidence collected in the research articles, a theoretical model is proposed as illustrated in Fig. 2. In this model, the hypothesis to be worked on later is proposed. This hypothesis states that soft skills and employee productivity positively and significantly affect organizational performance in operating companies in a regional context.

To determine the indicator variables, the following procedure was followed:

Soft skills: A literature review was conducted, and based on the evidence in the research results, a frequency matrix was created. Due to the large number of variables found in the literature review, those with a cumulative percentage of up to 70% were selected (principle 70 - 30). Fig. 4 reflects the result of frequencies obtained from the conclusions of research carried out on soft skills, similarly, Table 1 shows the research carried out by author, and the economic sector in which they were carried out.

Employee performance: Due to the scarce documentation and evidence in this field of knowledge, recent articles were taken that analyzed these variables through structural equations in order to determine the indicator variables.

Organizational performance: A literature review was conducted, filtering those documents with the highest number of citations in order to determine the indicator variables. Additionally, Table 1 provides a summary by economic sector of the research analyzed in the literature review carried out. In it, it can be seen that the largest amount of research has focused on a general environment, that is, not applied to a specific sector, followed by research focused on the educational sector.

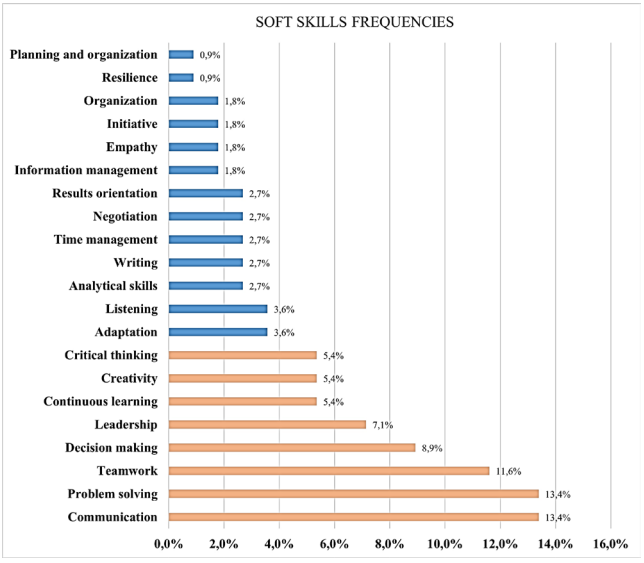

Figure 4. Soft skill frequencies. Made by the authors with the bibliographical references on which this research is based.
Source: [1,17,19,30,34-36,54-66]

Table 1.
Literature review by economic sectors.

Author / Economic sector of the research	Education	Engineering	Financial	General	Health	Information technology	Industry	Real state	Service
(Ismail, Yussof, & Sieng, 2011)									1
(Garwood, 2012)				1					
(Lavy & Yadin , 2013)						1			
(Abdol & Bahroom, 2014)	1								
(Sermsuk, Triwichitkhun, & Wongwanich, 2014)	1								
(Cimatti, 2016)				1					
(Mahfud, Kusuma, & Mulyani, 2017)					1				
(Olarinre & Taiwo, 2017)								1	
(Zepeda, Cardoso, & Rey, 2019)	1								
(Chaibate, Hadek, Ajana, Bakkali, & Faraj, 2020)		1							
(Rodge & Gupta, 2020)							1		
(Singh, Paul, & Tewari, 2021)				1					
(Suleman, y otros, 2021)	1								
(Khanom, 2021)				1					
(Rodríguez Martínez, Sierra Sánchez, Falcón Linares, & Latorre, 2021)				1					
(Constantino & Rodnizka, 2022)			1						
(Gruber, Barni de Campos, Pereira, & Borges, 2022)				1					
(Infante, Araiza, & López, 2023)	1								
(World Economic Forum, 2023)				1					
(Poláková, y otros, 2023)				1					
	5	1	1	8	1	1	1	1	1

Source: Made by the authors

Various investigations have shown the positive and significant relationship between soft skills and organizational performance [18, 52,67].

Based on the fundamental Pareto principle (70% - 30%), a selection is made of those variables that represent a total of 80% of the findings in the research carried out. The following are the variables that meet this requirement: Communication (SK_1); Problem solving (SK_2); Teamwork (SK_3); Decision making (SK_4); Leadership (SK_5); Continuous learning (SK_6);

Creativity (SK_7); Critical thinking (SK_8). In order to generate greater clarity regarding the eight filtered soft skills, and considered as observable variables for this research, these skills were defined in Table 2 to generate a greater degree of understanding due to their qualitative nature.

According to the authors consulted about employee productivity, the following measurement variables were identified: Willingness to Work (EP_1), Employees ability to work (EP_2), Employees work environment (EP_3), Employees work relationship (EP_4).

And finally, the observable variables of organizational performance were determined based on the available scientific literature: Experiencing an increase in return on investment (ROI) (OP_1), experiencing an increase in return on assets (ROA) (OP_2), experiencing an increase in profit (OP_3), improving the ability to retain old customers (OP_4), gaining new customers (OP_5), satisfying customers regarding acts or services during the last three years (OP_6), Producing competitive goods or services (OP_7), Responsive to the needs of national and international markets (OP_8), and improving global competitiveness(OP_9).

Based on the previously refined variables, the following relational model is proposed:

The structural model proposed in Fig. 5 shows a total of three latent variables, two independent variables, and one independent variable, and a total of 21 observable variables. The variable called SOFT SKILLS has 8 variables, EMPLOYEE PRODUCTIVITY has 4 variables, and ORGANIZATIONAL PERFORMANCE has 9 variables, the latter comprising financial and non-financial variables.

The mathematical composition of the structural model is formulated in Table 3.

Table 2.
Definitions of selected soft skills

Soft Skill	Description
Communication	Ability to convey, transfer and receive information, ideas and feelings.
Problem solving	Ability to identify and analyze the possible causes that originated the problem, as well as determine the consequences and finally propose different solutions taking into account the advantages and disadvantages of each.
Teamwork	Ability to effectively and cooperatively work in small groups toward a common goal.
Decision making	Ability to choose the best option to proceed to solve a problem, aware of the possible consequences or negative effects.
Leadership	Ability to influence and have an impact on others in the organization and display energy and leadership.
Continuous learning	Process of acquiring new knowledge, skills, and competencies throughout an individual's life or career.
Creativity	Ability to think about a task or a problem in a new or different way, and to use the imagination to generate new ideas.
Critical thinking	Ability to analyze information and use logic to address the issues, identify the strengths and weaknesses of alternative solutions or approaches to problems, and assess performance to make improvements or take corrective action.

Source: Made by the authors

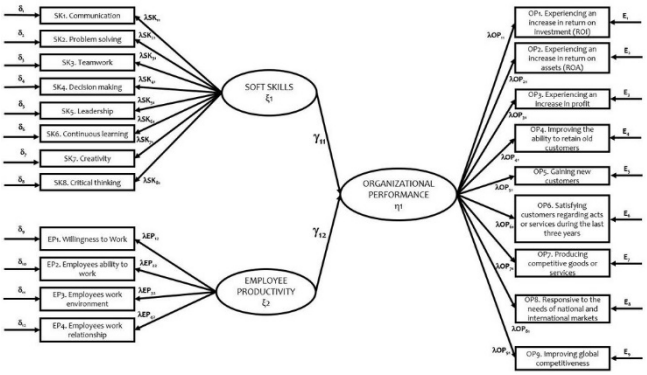

Figure 5. Proposed structural model.
Source: Made by the authors

Table 3.
Structural model equations

Latent Variable	Observable Variable
Soft Skills (SK)	SK_1 $\lambda SK_{11}\ \xi_1+\delta_1$
	SK_2 $\lambda SK_{21}\ \xi_1+\delta_2$
	SK_3 $\lambda SK_{31}\ \xi_1+\delta_3$
	SK_4 $\lambda SK_{41}\ \xi_1+\delta_4$
	SK_5 $\lambda SK_{51}\ \xi_1+\delta_5$
	SK_6 $\lambda SK_{61}\ \xi_1+\delta_6$
	SK_7 $\lambda SK_{71}\ \xi_1+\delta_7$
	SK_8 $\lambda SK_{81}\ \xi_1+\delta_8$
Employee Productivity (EP)	EP_1 $\lambda EP_{12}\ \xi_2+\delta_9$
	EP_2 $\lambda EP_{22}\ \xi_2+\delta_{10}$
	EP_3 $\lambda EP_{32}\ \xi_2+\delta_{11}$
	EP_4 $\lambda EP_{42}\ \xi_2+\delta_{12}$
Organizational Performance (OP)	OP_1 $\lambda OP_{11}\ \eta_1+E1$
	OP_2 $\lambda OP_{21}\ \eta_1+E2$
	OP_3 $\lambda OP_{31}\ \eta_1+E3$
	OP_4 $\lambda OP_{41}\ \eta_1+E4$
	OP_5 $\lambda OP_{51}\ \eta_1+E5$
	OP_6 $\lambda OP_{61}\ \eta_1+E6$
	OP_7 $\lambda OP_{71}\ \eta_1+E7$
	OP_8 $\lambda OP_{81}\ \eta_1+E8$
	OP_9 $\lambda OP_{91}\ \eta_1+E_9$

Source: Made by the authors

6 Discussion and Conclusions

Using a broad literature review, this research integrates scientific evidence from studies published between 2005 and 2024.

There is little evidence available about the influence of soft or interpersonal skills and employee productivity on organizational performance, however, the available evidence suggests a positive and significant influence, therefore, affecting the development of organizations in the short, medium and long term. Soft skills are as important as hard or technical skills, but so far they have not been equally valued. Soft skills are required by employers from their employees, which, like technical skills, impact business sustainability and, therefore, directly and indirectly affect job creation and other socioeconomic aspects. Despite the large list of soft skills identified in the literature, only some are the most frequent and significant, which at first could suggest their relative importance at the level of organizational development. Employee productivity is a widely researched field of study. There is scientific evidence of the variables through which it could be explained, both qualitatively and quantitatively. However, there is little scientific evidence of its influence on organizational performance. Through the review of different research carried out, it was demonstrated how soft skills and employee productivity are a factor that significantly and positively affects organizational performance, not only from a financial point of view, but also from a non-financial one.

Based on a review of the literature and the available evidence, a model was formulated to measure the impact of soft skills and employee productivity on organizational performance. Based on the identification of the exogenous observable variables identified, organizations will be able to carry out improvement and training plans with an optimization of investment costs, and focusing on those variables with the greatest impact for each organization. Likewise, with the use of this type of tool, not only would it be possible to promote business sustainability, but, additionally, the level of employee productivity would be increased, for the benefit of themselves and the organization.

According to the results identified from previous research, it is possible to determine how the soft skills proposed in this proposal can have a positive and significant effect on organizational performance, based on the identification of the identified variables, companies can generate training, and even career plans oriented to the development and appropriation of these categories of soft skills, since according to the evidence of the analyzed research, this type of skills positively and significantly affect financial organizational variables such as ROI, ROA, profits, and impact variables associated with customers, and therefore organizational competitiveness. These types of skills can be integrated into specific studies on hard skills, since these types of skills are not exclusive, therefore, the organization can generate training in specific hard skills, and include the appropriation of the soft skills identified in this research.

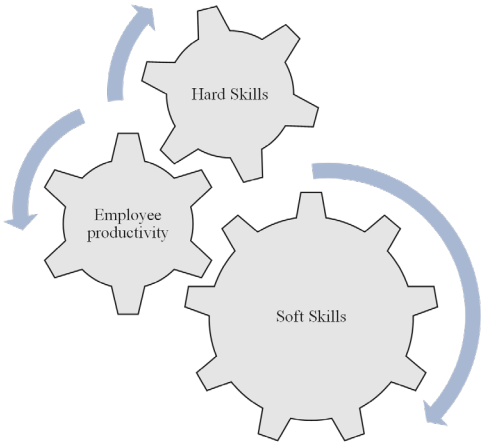

Figure 6. Integrated model for organizations.
Source: Made by the authors

Future research in this field is very promising, since it will be necessary to determine, by industrial sector, by type of organization and its size, the soft skills required to maximize its efficiency and financial and operational results. In this same sense, the future research required in this field is involved with the relationship of HBs in productivity, and individually in financial performance and operational performance; additionally, it should be an input at the level of higher education institutions for the identification and development routes within their academic programs of the soft skills that their students need, in order to maximize their professional performance.

One of the main added values derived from this research is the generation of a tool that gives organizations the ability to design, together with universities, specific training plans for their employees with an optimized investment on specific criteria, based on three fundamental principles shown in the Fig. 6:

The general structure presented in Fig. 6 has three pillars on which the training strategy should be formulated. The first pillar refers to hard skills, that is, to the specific knowledge required by the organization. The second pillar analyzes employee productivity, that is, the required knowledge. A special focus is made on ensuring that employees can apply said knowledge in practice in such a way that value is generated for the company and employees. Finally, the third pillar on which the training structure is based is the appropriation and development of soft skills related to the knowledge required by the organization in pillar 1.

Phase II of this research is based precisely on determining those soft skills that are required for their collaborators by various companies in the industrial sector of Bogotá and, in this way, identifying and implementing acquisition and development routes for these identified and prioritized skills within the Industrial Engineering program of the Universidad Militar Nueva Granada.

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Financial Performance Index (FPIMS): a proposal to measure the performance and project execution capacity in manufacturing companies in Santander (COL)

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Abstract
The manufacturing sector can be considered the main driver of economic growth in countries, as demonstrated by the macroeconomic variable GDP. However, during the pandemic, the historical rise in exchange rates and the increase in inflation and interest rates resulted in countries' negative performance. Currently, Colombia ranks last in the world in terms of productivity among OECD member countries. This problem is reflected in the Santander region, where production and sales variables have experienced negative changes, in addition to a stagnation in employment in the manufacturing sector. The objective of this work is to design a financial composite index to measure competitiveness, in addition to analyzing its implications for measuring performance and the capacity to execute projects in manufacturing companies. For the development of the research, an index called FPIMS was estimated for 2392 companies. Correlational analysis was then carried out and the companies were categorized. Finally, machine learning models were used to predict the FPIMS value. The results show that the proposed index can be a useful tool to determine project execution capacity in manufacturing companies in Santander.

Keywords: manufacturing sector; financial performance; competitiveness; project management; financial performance.

Índice de desempeño financiero (FPIMS): una propuesta para medir el desempeño y la capacidad de ejecución de proyectos en empresas manufactureras en Santander (COL)

Resumen
El sector manufacturero puede considerarse el principal motor del crecimiento económico de los países, como demuestra la variable macroeconómica. Sin embargo, en la época de la pandemia, el alza histórica de las tasas de cambio, el aumento de la inflación y de las tasas de interés se tradujeron en un desempeño negativo de los países. Actualmente, Colombia ocupa el último lugar mundial en productividad en relación con los países miembros de la OCDE. Esta problemática se ve reflejada en la región de Santander donde las variables de producción y ventas tuvieron cambios negativos, además de un estancamiento en el empleo del sector manufacturero. El objetivo de este trabajo es diseñar un índice compuesto financiero para medir la competitividad, además analizar sus implicaciones de para para medir el desempeño y la capacidad de ejecución de proyectos en empresas manufactureras. Para el desarrollo de la investigación se estimó el índice denominado FPIMS para 2.392 compañías, posteriormente realizó un análisis correlacional y se categorizaron las empresas, finalmente se emplearon modelos de aprendizaje automático para predecir el valor del FPIMS. Los resultados mostraron que el índice propuesto puede ser una herramienta útil para determinar la capacidad de ejecución de proyectos en las empresas del sector manufacturero en Santander.

Palabras clave: sector manufacturero; resultados financieros; competitividad; gerencia de proyectos; resultados financieros.

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1 Introduction

The industrial sector is the main engine of economic growth in countries around the world, driving the development of key macroeconomic variables such as gross domestic product (GDP), employment, poverty reduction, increased competitiveness, and productivity in emerging countries.

[1-4] , there is a relationship between economic indicators and financial performance [5].

Corporate financial performance can be defined as the overall corporate valuation of the main financial statements, balance sheet, the cash flow and the income [6]. In addition, capital structure influences a company's financial performance and results [7] is a key indicator, such as return on investment (ROI), sales growth, and earnings per share (EPS) [8].

Measuring company performance is of vital importance for companies; those that perform well are more likely to improve their long-term development, positively contributing to macroeconomic variables and society [9].

However, currently, in the scientific literature, there is ambiguity in financial performance and business crisis metrics, making it impossible to classify companies as "good "or "bad"[10].

The importance of the quality of financial information has an impact on the efficiency of the economic benefits of companies in the industrial sector, allowing the accurate evaluation of financial performance for decision making [11].

During the COVID-19 pandemic, financial and operating performance in industrial sector companies was affected. [12-14], due to stagnant production, restrictions, border closures, global conflicts, and uncertainty in the manufacturing sector, in addition to rising interest rates, inflation, and political uncertainty [15], profitability is the most affected sector due to the pandemic [16], generating distrust in the industrial sector [17].

On the other hand, in the global context of OCDE member countries analyzing labor productivity according to GDP per hour worked, the color scale shows green as the highest production per hour and red as the lowest, with the Nordic countries as the most productive, including Ireland with a value of 132 dollars per hour. However, Colombia ranked last in this category at 14.3 USD/Hour (Fig. 1).

At a regional level, according to the monthly manufacturing survey with a territorial approach conducted by DANE, the following are the most relevant data for the region [19], taking as cut-off June 2023-2024, analyzing the fundamental variables of the manufacturing sector such as production, sales, and employment in Fig. 2, it can be seen how only 4 departments represented in the green bar of the 15 studied achieved positive variations in real production, analyzing the department of Santander recorded a negative 6.9% in this variable.

The same behavior was seen in the variation of real revenues; only 26% of the total number of departments managed to increase their revenues; revenues the sector in the Santander department decreased by 8.3% (Fig. 3).

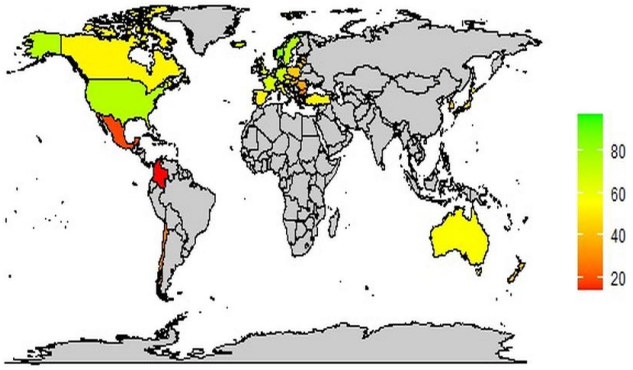

Figure 1. OECD's world productivity per hour worked
Source: National Competitiveness Report[18]

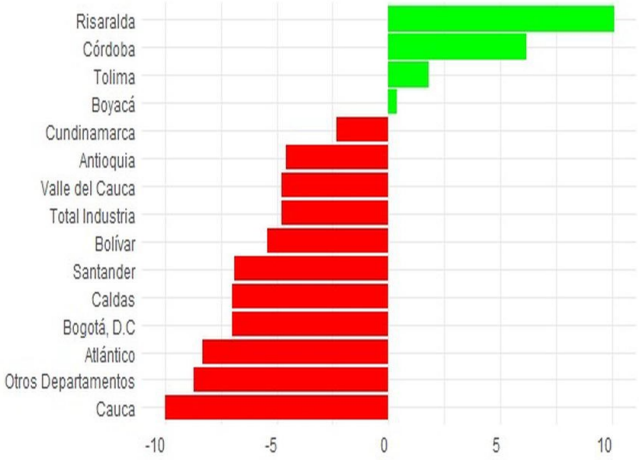

Figure 2. Variation in Real Production in the manufacturing sector Colombia June2023; Jun.
Source: DANE[19]

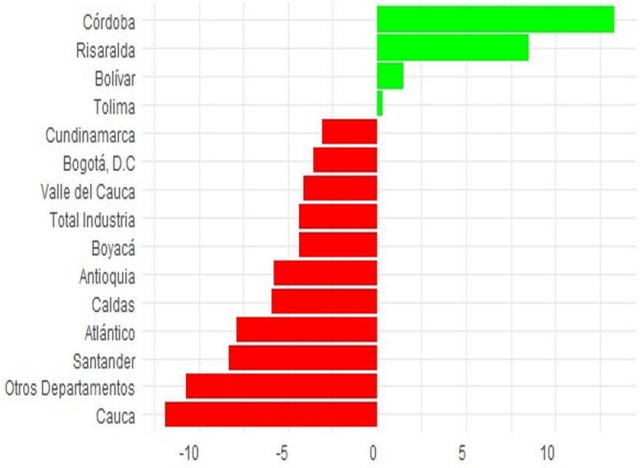

Figure 3 Variation in Real Revenues in the manufacturing sector Colombia June2023; Jun.
Source: DANE[19]

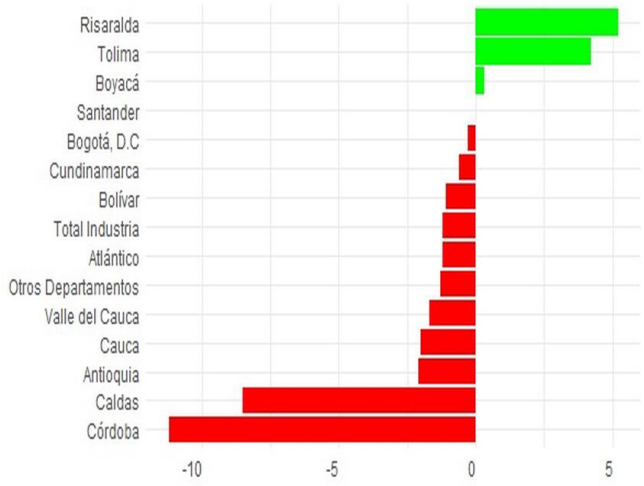

Figure 4. Changes in manufacturing employment
Source:
DANE[19]

Finally, in the employment variable, only three departments managed to increase this indicator; in the case of Santander, there was stagnation in the generation of new employment, with no positive or negative changes (Fig. 4).

In light of the above, the following research question is posed.

How can Santander's manufacturing sector design a financial performance index to measure performance and project execution capacity?

Considering the previous context, for Shumpeter, in the concept of economic development, entrepreneurs play a relevant role in countries' financial growth by including innovations and originality in products, markets, and methods, and the economy advances [20], [21]. Ansoff and E. J. McDonnell [22] stated that as a corporate strategy, business planning and the way it evaluates present and future corporate performance through the design of budgets is fundamental, where performance increases when planning is directed toward flexible and innovative environments[23]. On the other hand, competitiveness has been a fundamental factor of research since 1970 in different dimensions, nations, regions, sectors, companies and products. [24]. Porter's five forces model is an important reference in strategic management, where the integration of the model influences the profitability of the industry [25]. Resource-based theory studies how the company's multiple tangible or intangible resource bundles affect corporate performance, developing strengths or capabilities that allow a differentiating approach with the competition, optimizing resources, achieving superior performance and reaching sustainable competitive advantages [26]. It is important to incorporate corporate governance for the efficient management of resources to be competitive in the long term[27,28]. Competitive advantage is achieved through the resources of the companies or through cooperation between them [29].

2 Methodology

2.1 Data description

To perform the analysis of this research, information from the Compite360 platform, which offers information on the business dynamics of the Santander department in Colombia. This information contained 2392 records of companies in the manufacturing sector that presented information on their financial statements as of December 31, 2023. The variables involved in the analysis were the values reported for assets, liabilities, equity, sales, net profit, debt level, return on equity, return on assets, net margin, and debt-equity ratio. From the variables, the composite indicator called FPIMS was calculated as a financial measure that accounts for the performance and capacity to execute projects in manufacturing companies in the Santander department in Colombia. Correlations between the results obtained from the FPIMS and the origin variables were estimated. Subsequently, the manufacturing companies were classified according to their high, medium, and low performance according to the values ecorded by their FPIMS.

The methodological approach adopted in this study for the design of the FPIMS is the multivariate statistical technique of principal component analysis (PCA), for data processing we used the r Studio programming language with the R commander extension and the factor miner plugins.

The suitability of the sample for the application of the PCA technique is based on the Kaiser-Meyer-Olkin (KMO) and Bartlett tests, where values greater than 0.50 are acceptable for KMO and for Bartlett with a p-value of less than 0.001 [30,31], in addition, for the grouping of the variables, the total variance explained must be greater than 60% [32]. The rationale of this procedure is to allow recombining the base variables into a new group of several combined variables that are unrelated to each other, thus classifying different evaluation indicators and synthesizing the correlation between different parameters, achieving the location and interpretation of relevant data hidden in large data structures [33,34]. Finally, four machine learning models were used to estimate the value of the FPIMS. The models used were linear regression, decision tree, random forest, and gradient boosting.

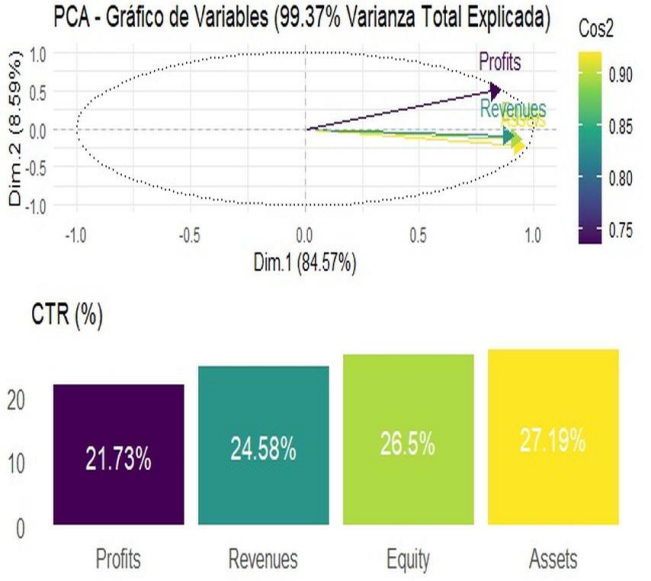

Figure 5. Analysis of dimensions and weighting of variables
Source: Authors' elaboration.

3 Results

The applied KMO and Bartlett tests showed results of 0.72 and 0.000, being convenient the application of the PCA, the above is in accordance with Çelik & Sürücü. (2024); Dotters-Katz et al. (2024) [35,36]. According to Fig. 5, the total variance explained in dimension 1 by the four variables is 84.57%, which is in accordance with previous studies of Cui et al. (2021) [37]. The same figure also presents the cosine of the variables and the weighting according to the PCA statistical method.

In the first instance, the composite index was calculated from the variables that make up the dataset and was called FPIMS, for which the following equation was used:

$$FPIMS = (0{,}27 * Assets) + (0.27 * Equity) + (0.24 * Revenues) + (0.22 * Profits) \quad (1)$$

A descriptive analysis of the FPIMS values is presented in Table 1.

Subsequently, a correlation analysis of the variables that make up the data set with the FPIMS was performed, which allowed us to establish that there is a high correlation between the variables Assets, Liabilities, Equity, Sales, and Net income with FPIMS, which suggests that the composite indicator tends to be higher in companies with a larger financial size, which can be considered as a scale of the company size. Likewise, the relationship between FPIMS and Net income reveals that companies with higher profitability have a higher value for the composite indicator (See Fig. 6).

Table 1.
FPIMS descriptive analysis

Category	FPIMS
Mean	10.095.455.047.224.000
Standard Dev.	4.554.506.791.535.490
Min	540.0
25%	5940792.0
50%	54000000.0
75%	328221607.5
Max	67763276930.0

Source: Authors' elaboration.

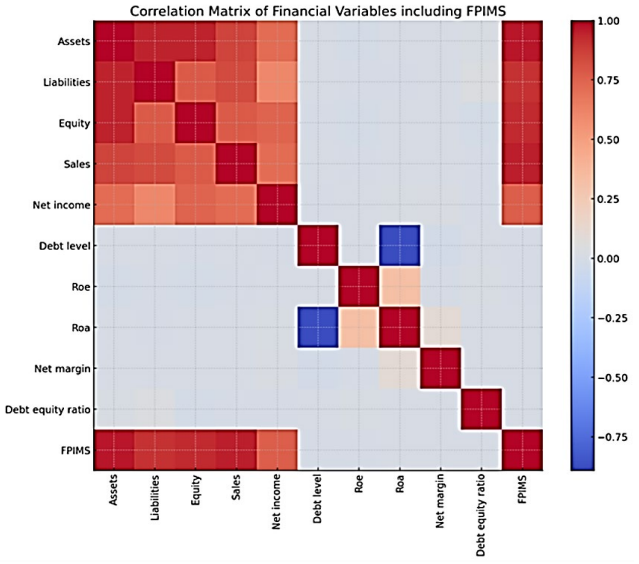

Figure 6. Correlation matrix of financial variables
Source: Authors' elaboration.

The distribution of companies according to their FPIMS levels was then carried out; however, the high dispersion of the data makes the graph difficult to interpret (See Fig. 7). Considering the above, the data were analyzed without considering outliers. In Fig. 8, a higher concentration of companies is observed at a high level; here, a high dispersion is also observed although the outliers are removed.

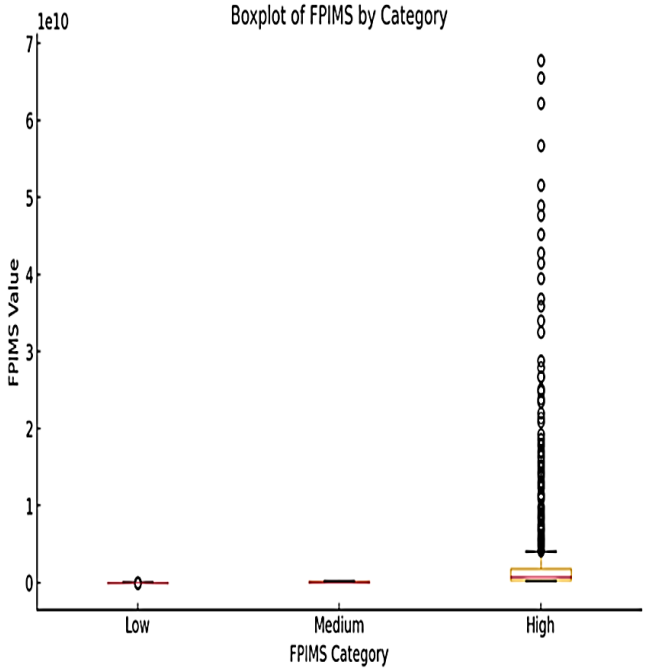

Figure 7. Boxplot of FPIMS by the category
Source: Authors' elaboration.

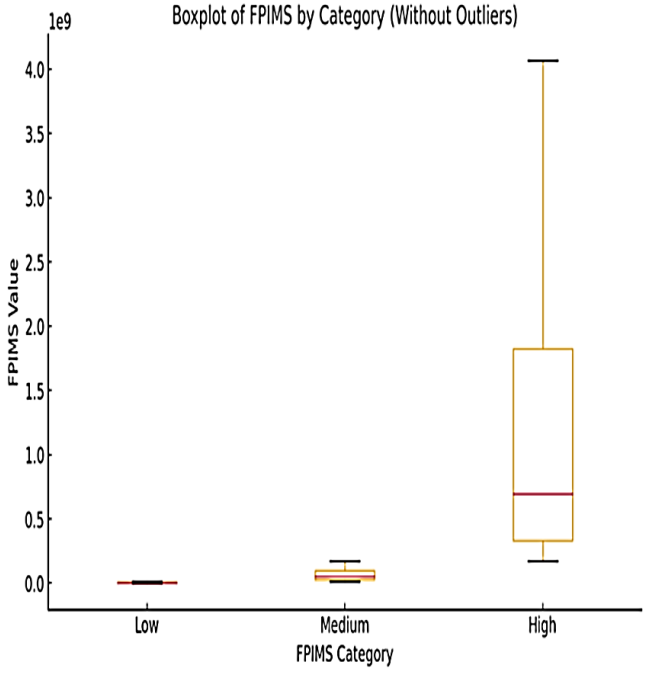

Figure 8. Boxplot of FPIMS by category without outliers
Source: Authors' elaboration.

To continue the analysis, four machine learning models were used to predict the FPIMS value: linear regression, decision tree, random forest, and gradient boosting. For each model, the current values were compared with the values that the prediction delivered. The results are presented below.

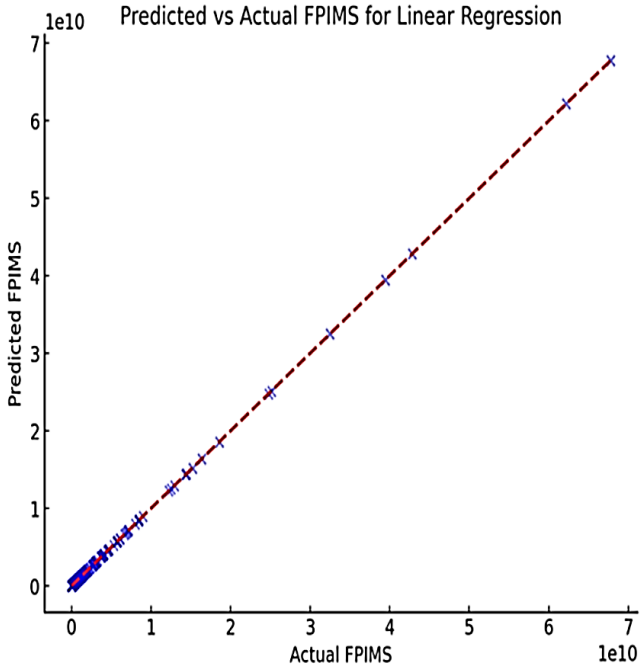

Figure 9. FPIMS Predicted by Linear Regression
Source: Authors' elaboration.

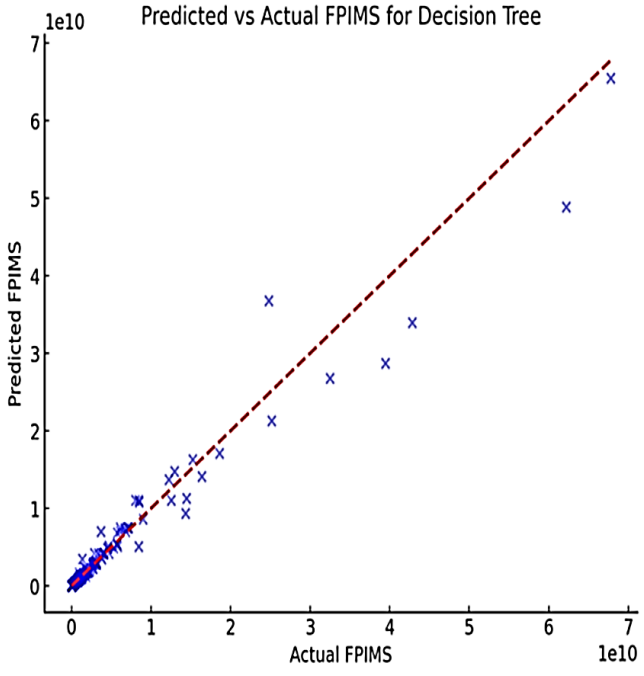

Figure 10. FPIMS Predicted with Decision Tree Model
Source: Authors' elaboration.

Based on the results of the machine learning model, we can infer that, for the linear regression model, the R^2 performance measure presents a value very close to 1, which indicates an almost perfect fit to the data. Despite this, the prediction may be influenced by the FPIMS estimation methodology, which is based on a linear equation.

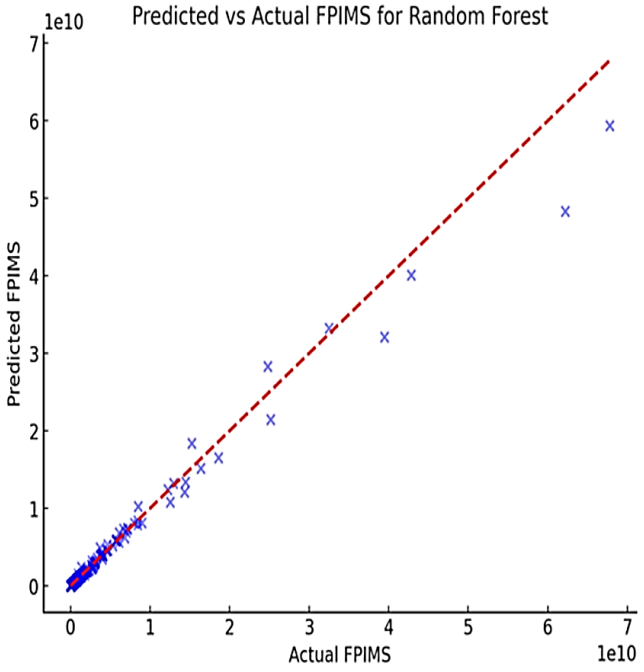

Figure 11. FPIMS Predicted with Random Forest Data
Source: Authors' elaboration.

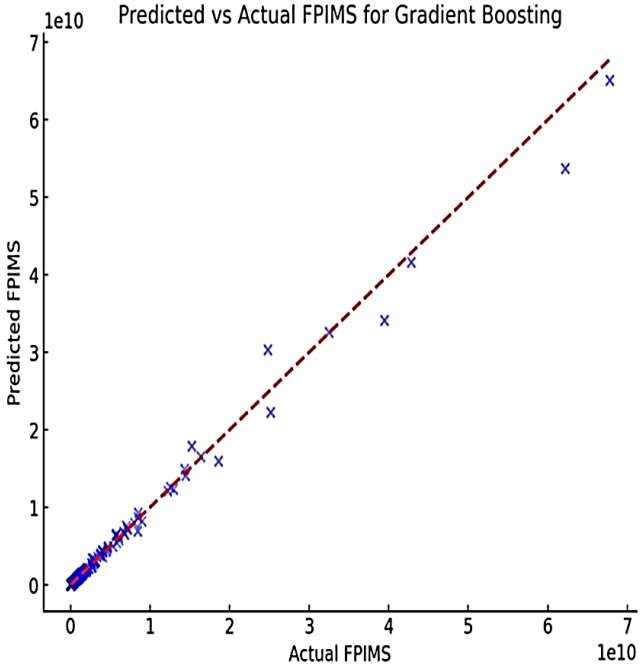

Figure 12. FPIMS Predicted with GradientBoosting
Source: Authors' elaboration.

Table 2.
Model's fit measures.

Model	R^2	RMSE
Linear Regression	7.251.443.036.590.290	0.99999
Decision Tree	1.190.025.549.022.340	0.95729
Random Forest	8.959.624.213.932.260	0.97579
Gradient Boosting	5.957.273.702.727.070	0.98929

Source: Authors' elaboration.

Considering the linearity of the model, it could be over-adjusted, so it is not advisable to consider this option when making the prediction (See Fig. 9). The results obtained using the decision tree model were $R^2 = 0.957$, which suggests a good fit. However, the RMSE result, another performance measure determined for the models, indicates a significant number of errors in its predictions compared with the other models performed (See Fig. 10).

Considering the performance results of the random forest model (see Fig. 10), it can be observed that it has better measures than the decision tree, with an R^2 of 0.976, and that, when considering the average of multiple decision trees compared to the previously mentioned model, it has a lower propensity to overfitting. Finally, the results of the gradient boosting model, presented in Fig. 12, show outstanding performance compared to the others, with an R^2 of 0.989 and the lowest RMSE of all, which suggests that it is the most accurate model to estimate FPIMS among the tested models. The R^2 and RMSE values of all models are presented in Table 2.

Considering the results obtained, the FPIMS, in terms of estimated values, performance levels in companies in the department of Santander, its correlation with financial variables, and the possibility of being predicted using machine learning, this index can be the basis for determining the performance and capacity to execute projects in manufacturing companies in the department of Santander from five perspectives. The first factor is related to companies' financial capacity to develop projects, considering that higher FPIMS may be related to greater liquidity and solvency. The second perspective considers the level of risk in developing projects, taking into account that a low FPIMS may suggest a higher risk if these companies attempt to carry out ambitious projects without the financial capacity to support them. Regarding the third perspective, the FPIMS can support the process of allocating resources to projects, if companies with a high FPIMS can take on larger projects, whereas those with a low FPIMS can focus on projects with less resource demand. The fourth perspective considers FPIMS as a tool that supports companies in building and optimizing project portfolios because it allows for the identification of the most feasible projects based on the company's financial strength. Finally, the fifth perspective offers the possibility that the FPIMS can be considered as an argument for obtaining project financing, taking into account that the PIMS shows the company as financially healthy and with a low probability of default.

4 Discussion

The manufacturing sector is considered a key driver of national growth and economic development[38]. However, the manufacturing sector faces several challenges related to achieving sustainable development, poverty reduction, and economic growth[39].

The analysis of financial indicators has conventionally been used to assess the financial health of companies by contrasting internal financial metrics with those of other companies in the same industry [40]. Financial efficiency is of interest to internal and external stakeholders for strategic decision-making and is fundamental for the sustainability of companies evaluated through financial metrics that allow to analyze the economic behavior of the company [41]. This financial decision-making can be supported by financial forecasting models[42]. Identifying how to mitigate companies' financial risks and promote innovation is a fundamental factor for the economic development of countries' economies [43].

The case of emerging economies, such as Colombia, specifically the manufacturing sector of the Santander region. The results obtained confirm that since there is a high correlation between financial accounts assets, equity, sales, and income with the FPIMS index, the scale of financial performance is related to the size of the company. Company size can become a performance challenge for profitable production and financing metrics [44]. Large companies have more robust and modern systems that allow better management of information for decision making, reducing risk and allowing them to access more sources of financing at lower cost, which improves financial performance [45]. On the other hand, small and medium-sized enterprises (SMEs) present various challenges in terms of innovation and sustainability due to the existence of barriers in accessing sources of financing[46]. Currently, the sector under study is facing specific problems related to the increase in fuel prices, the deterioration of the region's roads, the lack of financial inclusion of SMEs and the lack of innovation leading to high costs for entrepreneurs that are extrapolated via price, generating loss of competitiveness in the sector.

In addition, it is important to manage project financial risks as a subset of overall project risk management and as a key variable for project compliance derived from funding and profitability, with financial performance becoming a critical factor in the success of a project [47,48]. It is essential that the project office calculates the financial performance and evaluates the results obtained in all phases of the project to find the optimal financial structure and balance between investment and profits [49].

Having non-conventional metrics to measure the financial performance of projects in the region of Santander, the manufacturing sector will allow to analyze the competitiveness of the sector, carrying relevant information to decision makers in order to mitigate financial risks to adopt strategies to improve the financial performance of companies, leading to the generation of corporate value or that will strengthen the financial sustainability contributing to the improvement of macroeconomic metrics achieving local and regional economic development. Therefore, financial results can be considered as the quantification of the objectives achieved by the companies as presented in financial metrics [50].

5 Conclusion, limitations, and future directions

After developing the research in which the Financial Performance Index (FPIMS) was proposed and analyzed, the four main conclusions are shown below. First, the capacity of

the FPIMS is to reveal the capacity of organizations to develop projects. In this way, and based on the identified correlations of the index with the variables of assets, liabilities, and net income, it can be stated that it also offers the possibility of estimating the financial strength and size of companies. The second conclusion is related to the machine learning models used for the prediction of the FPIMS (linear regression, decision tree, random forest, and gradient boosting), considering that in general, the performance measures showed a good level of fit. However, the gradient boosting model is the most suitable for monitoring financial performance.

The third conclusion is related to the practical implications of FPIMS because the analysis conducted on the companies allowed them to be classified according to their solidity, which can support strategic decision-making processes, resource allocation, and the creation of project portfolios, considering that companies with a high level of FPIMS may have a greater capacity to develop large projects. Finally, the fourth conclusion is related to the opportunity that the FPIMS offers to contribute to the competitiveness of the manufacturing sector in the Santander region considering that it can offer useful information for reducing financial risks and improving performance, which can be key to the growth of the said sector. It is necessary to consider a number of important limitations of this study: first, this study used cross-sectional data; future studies may use longitudinal data that would allow corroboration of the findings presented. Secondly, the study was based on quantitative methods, which analyze large volumes of data; future research may focus on mixed methods, which include case studies, focus groups, and focus groups to validate the numerical results.

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The ambidextrous scorecard: a strategic tool for balancing exploitation and exploration in the hospitality sector

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Abstract
In today's organizations, the ability to exploit their current business while simultaneously seeking new opportunities has become a key strategy. This requires balancing activities that are often contradictory and challenging to pursue simultaneously to generate synergy between operational efficiency and innovation. This paper proposes a framework for managing exploitation and exploration activities using the Balanced Scorecard. To achieve this, a quantitative exploratory study was conducted in 48 four-star hotels in Puebla City, Mexico. Using a questionnaire, the exploitation and exploration activities undertaken by these hotels were characterized to design an Ambidextrous Scorecard proposal. The findings suggest that this tool facilitates decision-making and contributes to more effectively managing these activities in the hospitality industry.

Keywords: project management; organizational ambidexterity; exploitation; exploration; balanced scorecard; strategic management.

El Cuadro de mando ambidiestro: una herramienta estratégica para equilibrar la explotación y la exploración en el sector hotelero

Resumen
Para las organizaciones actuales, la capacidad de explotar su negocio mientras buscan simultáneamente nuevas oportunidades se ha consolidado como una estrategia clave. Esta demanda el equilibrio de estas actividades que suelen ser contradictorias y difíciles de desarrollar de manera simultánea, con el fin de generar sinergia entre la eficiencia operativa y la innovación. Este trabajo propone un marco para gestionar las actividades de explotación y exploración mediante el uso del Cuadro de Mando Integral. Para ello, se realizó un estudio exploratorio cuantitativo en 48 hoteles de cuatro estrellas de la Ciudad de Puebla, México. A través de un cuestionario, se caracterizaron las actividades de explotación y exploración llevadas a cabo por estos hoteles, con el objetivo de diseñar una propuesta de Cuadro de Mando Ambidiestro. Los resultados sugieren que esta herramienta facilita la toma de decisiones y contribuye a una gestión más efectiva de estas actividades en la industria hotelera.

Palabras clave: gestión de proyectos; ambidestreza organizacional; explotación; exploración; cuadro de mando integral; gestión estratégica.

1 Introduction

In Puebla City, Mexico, where tourism plays a pivotal role in the local economy, the hotel sector has established itself as a cornerstone. Hotels not only provide accommodation but also mirror the region's colonial architecture and cuisine, reflecting the region's culture, tradition, and hospitality. However, in such a saturated and ever-evolving market, hotels must continually innovate without neglecting the operational efficiency that ensures their survival and success. Academic literature proposes organizational ambidexterity as a solution, stressing the need to balance innovation with efficiency. Despite its acknowledged significance, there is a lack of research on how to achieve this balance comprehensively. Numerous studies have tackled the subject in a fragmented manner, overlooking the intricacies and unique aspects of the hotel sector, especially in regional contexts

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such as Puebla's. Given this evident gap, this paper proposes a framework for managing exploitation and exploration activities using the Balanced Scorecard (BSC).

Organizational ambidexterity emphasizes balancing exploitation (efficiency and optimizing existing resources) with exploration (seeking new opportunities and adapting to change) activities within the organizational structure and strategy [1,2]. This dual capability, as described by Gibson and Birkinshaw [3], allows hotels to be both aligned (efficient) and adaptable (flexible) in response to current market demands while preparing for the future. Exploration activities, associated with search, variation, and experimentation [4,5], focus on discovering new opportunities and adapting to changing contexts [6,7]. Exploitation, on the other hand, aims to refine and leverage existing competencies for enhanced performance [8,9].

Striking a balance between these capabilities represents an inherent challenge since overemphasizing one can inhibit the other [4,10]. However, the literature suggests that organizational ambidexterity might be a competitive advantage, allowing organizations to adapt to environmental shifts while maintaining operational efficiency [3,11]. Furthermore, it is posited that ambidextrous organizations are more likely to achieve superior performance since they can innovate while keeping their current operations streamlined [12,13].

The BSC emerged as a fundamental tool for organizational management, offering a holistic view that transcends traditional financial metrics [14]. It empowers organizations, like hotels, to effectively address environmental challenges and stakeholder demands [15,16]. This is particularly relevant for the hotel industry, where balancing exploitation (efficiency) with exploration (innovation) activities is crucial for long-term success. The BSC's design, based on cause-and-effect relationships and balancing financial and non-financial indicators [17-19], positions it as a strong candidate to support ambidexterity efforts. By linking actions across various perspectives (financial, customer, internal process, and, learning and growth), the BSC provides an integrated management framework to help hotels navigate the challenges of balancing short-term performance with long-term innovation [20].

The implementation of the BSC can vary based on a hotel's organizational maturity. Some hotels might adopt a simpler version focused on key performance indicators (KPIs), while others might strive for a more comprehensive approach to influencing strategic direction [21-23]. However, challenges exist, including overcoming resistance to change and adapting the BSC to the hotel's specific context [24,25]. These challenges mirror those encountered when pursuing organizational ambidexterity, as both require significant cultural and structural shifts [13]. Despite these hurdles, the BSC's strength lies in its ability to bridge strategy with action, translating the hotel's vision into concrete initiatives [26]. This focus on action is particularly valuable for achieving ambidexterity in the hotel industry, as it empowers hotels to balance the competing demands of exploitation (efficiency) and exploration (innovation) for long-term success.

Organizational ambidexterity, as defined by Duncan [27], refers to an organizational structure that fosters both innovation and efficiency simultaneously. This dual capability, as Lubatkin et al. [28] suggest, necessitates an organization's ability to exploit existing capabilities while actively exploring new opportunities. Essentially, it allows hotels to cater to current markets while innovating for the future [12]. Achieving this balance often requires specific tools and approaches. The BSC developed by Kaplan and Norton [29] is a strategic management tool well-suited for this challenge.

2 Materials and methods

A quantitative-deductive approach was adopted to analyze the relationships between study variables in a cross-sectional non-experimental design. To identify patterns and correlations [30,31] a sample of 48 four-star hotels in Puebla City was selected, representing 24.74% of the hotels' total. Despite a rejection rate of 14.58%, data was collected at a single point in time, avoiding manipulation of variables [32].

A structured survey was chosen as the measurement instrument, divided into three sections. The first section aimed to establish trust with participants, explaining the research objective and guaranteeing data confidentiality. The second section collected sociodemographic information about both the respondent and the hotel, to characterize the sample and establish possible relationships with the study variables. Finally, the third section, the core of the survey, inquired about the hotel's exploitation and exploration activities from the four perspectives of the BSC.

To validate the survey content, the Delphi method was employed. Following López-Gómez's guidelines [33], a panel of tourism and hospitality experts was formed. Upon receiving feedback, the experts confirmed that the instrument effectively measured the variables, although they suggested minor adjustments to the wording.

Subsequently, a pilot test was conducted with a sample of twenty tourism professionals from Colombia, Spain, and Mexico. The results obtained from eleven questionnaires allowed for an assessment of the survey's reliability. Using Cronbach's alpha coefficient, internal consistency was determined to be adequate, with a general value of 0.759 and individual construct values exceeding 0.70. This result aligns with criteria established by various authors [34-37], who consider a coefficient of 0.70 or higher to indicate good internal consistency in exploratory research (Table 1).

When comparing the correlations of the variables with the values on the diagonal formed by the alpha coefficients, it was observed that the former was lower than the latter. This result suggests that the survey items adequately measure the construct being evaluated (Table 2).

Table 1.
Cronbach's Alpha reliability for analyzed variables.

Variable	Cronbach's Alpha
Global	0.759
Financial	0.768
Customer	0.752
Internal	0.764
Learning & Growth	0.701

Source: Prepared by the authors.

Table 2.
Correlation Matrix and Cronbach's Alpha Coefficients.

	Financial	Customer	Internal	Learning & Growth
Financial	0.768			
Customer	0.426	0.752		
Internal	0.595	0.692	0.764	
Learning & Growth	0.249	0.238	0.537	0.701

Source: Prepared by the authors.

Table 3.
KMO and Barlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**0.784**
Barlett's Test of Sphericity	Approx. Chi-Square value	210.45
	Degrees of Freedom	10
	Significant Value	0.0001

Source: SPSS results.

The Kaiser-Meyer-Olkin (KMO) test, conducted following Shrestha's [35] recommendations, yielded a value of 0.784, indicating satisfactory sample adequacy for factor analysis, according to the author (Table 3). This result confirms the suitability of the data for the study.

Using SPSS statistical software, the collected data was organized into a tabulation matrix. Variables were classified according to the BCS perspectives (financial, customer, internal process and, learning and growth) to analyze the integration of exploitation and exploration activities. Quantitative techniques, such as descriptive statistical analysis and Pearson correlation, were employed to obtain detailed information and determine the relationships between variables.

3 Results

Exploitation activities, which focus on efficiency, consolidation, and optimization, are vital for organizations aiming to refine and maximize the performance of their existing products, services, and processes. Considering that revenue management within exploitation activities is crucial, the findings show that 88.9% of the hotels increased the prices of their products and services. This decision, characteristic of an exploitation strategy, aims to maximize the benefits of the hotel's current capacities. On the other hand, the hotel occupancy rate, a key indicator of operational efficiency, exhibited significant adaptation to external challenges. Despite dropping from 57% in 2019 to 41% in 2022, a decline attributed to the COVID-19 pandemic, the hotels demonstrated resilience—a core trait of exploitation activities—by showing signs of recovery in 2021.

Staff training, regarded as an investment in enhancing existing capabilities, emerged as a predominant exploitation activity where 80% of the hotels invested in training with an emphasis on customer service and the utilization of digital tools, aiming to improve the efficiency and quality of the service provided. These were also prominent strategic alliances, which can be perceived to exploit shared capacities and resources with other sector stakeholders. 72.7% of the hotels established alliances primarily to develop new products or services and diversify marketing options, thus maximizing their market reach and efficiency.

Exploration activities that drive experimentation, innovation, and discovery are fundamental for organizations seeking to develop new products, services, or capabilities. In this regard, it was found that 80% of the hotels in Puebla invest in entirely brand-new innovation projects, reflecting a strong inclination towards exploration activities. However, only 50% of these establishments have staff dedicated to such initiatives. This distribution suggests a diversity in how hotels approach innovation. While some are structuring their resources to favor exploration, others are balancing both activities without a clear division. Nonetheless, it is essential to note that not all hotels investing in innovation have exclusive personnel for it, indicating that some hotels may be sequentially or contextually balancing exploration and exploitation.

Funding is a key indicator for understanding the priority of innovation within organizations. In this light, 62.5% of hotels allocate between 5% and 10% of their annual budget to innovative projects. While this figure might seem modest, it translates into financing two or three projects, revealing a strategic and selective approach. Notably, these projects vary in focus, ranging from process innovation aimed at optimizing operations to innovations in business models, organizational structure, products, services, and distribution channels.

Referring to identifying and capturing new market segments, 45.5% of the hotels employ up to three different strategies to attract new clientele. These strategies span from traditional environmental and target audience analyses to more contemporary approaches, such as bolstering their presence on social media platforms. This shift toward the digital sphere underlines the sector's evolution in response to current trends. Even though only 8.8% of hotels introduce new product or service categories, most employ multiple strategies to encourage innovation among their staff, including understanding client needs and analyzing competition.

In this context, technology plays a pivotal role. At least 36.4% of hotels have acquired new technologies to enhance their processes and operations, with tools such as direct booking systems and contactless financial transactions becoming essential, in response to the shifting demands of the post-pandemic market. Nevertheless, human resources remain essential despite the significance of exploration and technology. A notable 90% of hotels have succeeded in enabling their staff to gain new knowledge and skills. The strategies to motivate this acquisition vary, but promotions and personal self-realization stand out as predominant, highlighting the importance of intrinsic motivation in the sector.

The hotel industry in Puebla City is characterized by a multitude of activities about both exploitation and exploration. These manifest across a range of dimensions, including the allocation of resources, the structure of organizational entities, the adoption of technology, and the training of personnel. Although Puebla's hotels navigate a complex and ever-evolving environment they can

remarkably balance exploitation and exploration in their daily operations. This allows them not only to adapt to a changing environment, but also to innovate and uncover new opportunities, all while ensuring the efficiency and efficacy of their existing operations.

4 Discussion

The hospitality industry, particularly in cities like Puebla, faces significant challenges in maintaining the quality and tradition expected by visitors while simultaneously innovating to meet the evolving demands of the globalized market. Based on this premise, this study addresses the need to balance exploitation and exploration activities [3], acknowledging that strategies to achieve this can vary across organizations. Although existing approaches to organizational ambidexterity have provided significant benefits, they tend to separate these activities into distinct units or reduce them to the development of specific skills in employees.

While these strategies have proven effective, their success can be limited by potential conflicts between units or teams, hindering collaboration and stifling innovation. In response to this challenge, the concept of integrated or holistic ambidexterity is proposed, an approach that seeks to fully integrate exploitation and exploration activities throughout the organization. With this perspective, organizational ambidexterity is not viewed as an isolated element but rather sought to be incorporated into all business areas and processes. To achieve this, the Ambidextrous Scorecard (ASC) is proposed as a tool that facilitates the monitoring and integrated management of both activities, providing a holistic view of the organization and enabling more informed decision-making.

This approach, by promoting a balance between exploitation and exploration, requires an organizational structure that facilitates interdepartmental collaboration and fosters processes that stimulate communication and learning among different units. Table 4 details the key aspects of this proposal.

The implementation of this approach within organizations presents a new challenge that can be addressed from the perspective of the ASC. This tool plays a pivotal role in monitoring and aligning an organization's short-term and long-term objectives and actions, harmonizing exploitation and exploration activities. A distinctive feature of the ASC is its ability to identify and prevent conflicts between these activities, which is crucial for organizations seeking to balance them effectively. Moreover, the ASC provides a holistic view of the business, supporting informed decision-making, the development of dynamic capabilities, and the creation of a sustainable competitive advantage.

The ASC emerges as a response to the inherent challenges of exploitation and exploration activities, which have been addressed through various approaches. However, the ASC goes a step further by seeking a holistic alignment of these activities with the organization's strategy and resources. The introduction of the ASC in the hospitality sector represents a significant advancement in the management of exploitation and exploration activities, proposing a set of key generic factors to address them effectively.

Table 4.
Critical Aspects of Integrated Approach.

Orientation	Advantages	Disadvantages	Usage conditions
Holistic, encompassing the entire organization	Maintains a clear orientation towards strategic objectives. Allows agile adaptation and continuous innovation.	Risk of lack of focus and clear strategic direction. It is challenging to implement in large or complex organizations.	When a strategic and integrated approach to exploitation and exploration is required. Suitable for organizations facing a complex and dynamic environment.

Source: Prepared by the authors.

Table 5 details the ASC proposal, presenting 11 strategic objectives and 23 indicators. While this is a generic proposal, each hotel or organization must adapt it to its specific needs and circumstances. It is worth noting that the empirical basis of this proposal is derived from the applied questionnaire, reinforcing its relevance and applicability in the hospitality context.

Table 5.
Proposed Ambidextrous Scorecard for the hotels of Puebla City.

Perspective		Strategic Objectives	Strategic Indicators (SI)
Financial perspective (F)	Exploitation	F1. Reduce operational costs	SI1. Rate of cost reduction to total revenues. SI2. Net profit margin.
	Exploration	F2. Diversify sources of income	SI3. Percentage of revenue from new products/services relative to total revenue. SI4. Percentage of expenses allocated to research and development activities relative to total operating expenses.
Customer perspective (C)	Exploitation	C1. Expand/improve the current offering of products and services	SI5. Percentage of customers who have used new products/services in the last quarter. SI6. Customer satisfaction index with new products/services. SI7. Increase in revenue per available room due to the new products/services offered.
		C2. Identify and anticipate customer needs	SI8. Customer satisfaction index with the service received. SI9. Number of customer complaints

Perspective		Strategic Objectives	Strategic Indicators (SI)
			received relative to the total number of customers. SI10. Customer retention rate.
	Exploration	C3. Address new market segments	SI11. Percentage of revenue from new market segments relative to total revenue. SI12. The growth rate of the new market segments about the existing ones. SI13. Customer satisfaction index for the new market segments served.
Internal Process perspective (P)	Exploitation	P1. Provide quality service	SI14. Percentage of customer satisfaction, number of complaints or claims received, average response time to customer requests.
		P2. Establish strategic alliances	SI15. Number of strategic alliances established, percentage of improvement in operational efficiency through established alliances, and return on investment (ROI) from the alliances.
		P3. Analyze the environment	SI16. Number of environmental analysis reports conducted, accuracy percentage in forecasting market trends, response rate, and adaptation to environmental changes.
	Exploration	P4. Innovate in processes, products, and services	SI17. Number of innovative ideas proposed, percentage of successfully implemented ideas, average implementation time.
Learning and Growth Perspective (LG)	Exploitation	LG1. Utilize current skills	SI18. Percentage of employees trained in skills relevant to the business. SI19. Turnover rate of trained employees. SI20. Employee satisfaction index.
	Exploration	LG2. Develop new skills	SI21. Percentage of new skills developed about market needs. SI22. Percentage of employees trained in new skills. SI23. The adoption rate of new skills in job performance.

Source: Prepared by the authors.

As shown in Table 5, the original four perspectives of the BSC bifurcate into two dimensions: exploitation and exploration. From a financial perspective, while exploitation focuses on operational efficiency, reflected in indicators such as 'net profit margin', exploration is oriented toward revenue diversification, as evidenced by metrics like the ‘percentage of revenue from new products/services relative to total revenue'. This duality ensures sustainable hotel management that is adaptable to market fluctuations.

From a customer perspective, the importance of satisfying both current and potential customers is highlighted. Exploitation is manifested in the continuous improvement of the current offering, while exploration is oriented towards capturing new market segments and improving customer experience. These objectives underscore the direct relationship between customer satisfaction and profitability. In terms of internal process, exploitation focuses on service quality and the consolidation of strategic alliances, while exploration seeks constant innovation. This duality reinforces the need for a balance between operational efficiency and adaptability to changing market demands. Finally, the learning and growth perspective highlights the importance of human capital, where exploitation refers to leveraging the current skills of personnel, while exploration focuses on developing new competencies. The combination of these objectives ensures that the organization benefits from both accumulated experience and newly acquired skills.

5 Conclusions

This research focused on proposing a framework for managing exploitation and exploration activities using the Balanced Scorecard in the hotel sector of Puebla City, Mexico. The findings reveal that, instead of considering exploitation and exploration activities as isolated elements, it is essential to integrate them into all organizational areas and processes through the Ambidextrous Balanced Scorecard (ASC). Moreover, it is evident that such integration not only enhances performance in each of the original perspectives of the Balanced Scorecard (financial, customer, internal process, and learning and growth) but also significantly contributes to the overall performance of hotel organizations, effectively balancing the exploitation of current resources and competencies with the exploration of new opportunities.

When comparing these results to existing literature, it was found that they were consistent with previous studies that highlight the need to integrate exploitation and exploration activities into both organizational structure and strategy. However, this work went a step further by delving into the relevance of the ASC as an essential tool for integrated management, emphasizing how the combination of these activities within this framework provides a new perspective on how hotel organizations can improve their performance and adaptability in an ever-evolving market that presents increasingly complex challenges.

The practical implications of these findings suggest that hotels that effectively integrate exploitation and exploration activities with the help of the ASC can position themselves more competitively by anticipating trends and responding swiftly to market demands. Furthermore, this study

theoretically reinforces the idea that efficiency and adaptability are complementary in the hotel context and that it is important to consider exploitation and exploration activities from a holistic perspective.

Nevertheless, it is important to acknowledge the limitations of this study. Despite the meticulous effort to comprehensively address the hotel sector in Puebla City, Mexico, it is emphasized that the findings should be interpreted with caution and the particularities of the studied context should be considered. However, looking to the future, it is suggested to explore how this approach can be implemented in other sectors or geographic regions. Additionally, it would be relevant to delve deeper into how emerging trends, such as digitalization, sustainability, or changing consumer preferences, influence exploitation and exploration activities within the hotel industry.

Ultimately, this study unveiled the significance of integrating exploitation and exploration activities within the Balanced Scorecard. Beyond empirical findings, the potential of the ASC proposal is highlighted to enhance performance and adaptability in the hotel industry, offering a valuable contribution to both academia and hotel industry professionals and decision-makers.

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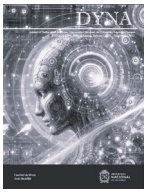

UNIVERSIDAD NACIONAL DE COLOMBIA

Dynamic absorption capacities and their relationship with the maturity of quality management systems

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Abstract
The rapid pace of technological change, evolving market demands, and global economic volatility drive organizations to continually seek operational efficiency. This pursuit often involves adopting strategies that emphasize responsiveness and anticipation, ensuring a sustainable position in the medium to long term. The concept of competitive advantage refers to an organizational capacity to create value that meets the needs of its customers. Quality management systems can be a source of competitive advantage for organizations if the capabilities necessary to achieve a distinctive position are strengthened. Therefore, dynamic absorptive capacities become meaningful, with knowledge being the true source of organizational differentiation. This research aimed to establish the relationship between dynamic absorptive capabilities and the maturity level of quality management systems. In this study, 100 quality leaders were surveyed. The data were processed through a multivariate factor analysis method. The preliminary conclusion of the study shows that quality management systems should mature at the same time as the dynamic absorption capacities of organizations. Highlighting the importance of human talent and the development of its capabilities as key factors to ensure quality and create value for the various stakeholders.

Keywords: dynamic absorption capacities; quality management systems; maturity; competitive advantage, project management.

Capacidades dinámicas de absorción y su relación con la madurez de los sistemas de gestión de calidad

Resumen
El rápido ritmo del cambio tecnológico, las demandas cambiantes del mercado y la volatilidad económica global impulsan a las organizaciones a buscar continuamente la eficiencia operativa. Esta búsqueda a menudo implica la adopción de estrategias que enfatizan la capacidad de respuesta y la anticipación, asegurando una posición sostenible en el mediano y largo plazo. El concepto de ventaja competitiva se refiere a la capacidad organizacional de crear valor que satisfaga las necesidades de sus clientes. Los sistemas de gestión de la calidad pueden ser una fuente de ventaja competitiva para las organizaciones si se fortalecen las capacidades necesarias para lograr una posición distintiva. Por lo tanto, las capacidades dinámicas de absorción adquieren significado, siendo el conocimiento la verdadera fuente de diferenciación organizacional. Esta investigación tuvo como objetivo establecer la relación entre las capacidades dinámica de absorción y el nivel de madurez de los sistemas de gestión de la calidad. En este estudio, se encuestó a 100 líderes de calidad. Los datos fueron procesados mediante un método de análisis factorial multivariado. La conclusión preliminar del estudio muestra que los sistemas de gestión de la calidad deberían madurar al mismo tiempo que las capacidades dinámicas de absorción de las organizaciones, Destacando la importancia del talento humano y el desarrollo de sus capacidades como factores clave para asegurar la calidad y crear valor para los distintos grupos de interés.

Palabras clave: capacidades dinámicas de absorción; sistemas de gestión de calidad; madurez; ventaja competitiva, gerencia de proyectos.

1. Introduction

To achieve success, modern organizations must adjust their management methods by transforming their capabilities through innovation and the adoption of new knowledge, as well as leveraging emerging technologies. This is essential for ensuring the efficiency and continuity of their processes [1]. The ability to constantly adapt becomes crucial for maintaining

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quality and positioning in the global market, achieving a balance between long-term results and day-to-day decisions [2].

In this sense, it is evident that knowledge plays a fundamental role in organizational maturity. This involves acquiring new resources, developing capabilities, and promoting a corporate culture that encourages creativity, adaptability, and the adoption of best practices in internal processes and management. These elements become a crucial differentiator, allowing organizations to anticipate market needs, improve performance indicators, and offer products and services that more effectively meet the demands of the environment [3]. To drive organizational transformation, dynamic absorption capabilities become a crucial element in the design and adoption of quality management systems (QMS) [4]. These capabilities are implicitly defined as the ability of an organization to manage knowledge and create value, which involves the acquisition, assimilation, transformation and exploitation of knowledge [5].

From this perspective, quality can be understood as a key factor in the design of processes, products, and services, thereby generating a competitive advantage [6]. However, in recent years, quality management theory shows less transformation, neglecting innovation and leadership among professionals working in this field [7]. This stagnation has resulted in a disconnection between quality management systems (QMS) and organizational knowledge management, affecting the robustness and transformation of the designed and adopted standards [8]. Likewise, although the combination of quality management systems with innovation and knowledge management can generate significant synergistic benefits, organizations face considerable obstacles, such as the availability of human talent with the required skills, the high costs associated with innovation, and the need to promote a corporate culture that values and encourages knowledge management as a key element in organizational strategy [9].

On the other hand, the fourth industrial revolution, or Industry 4.0, proposes the digital transformation of industries through innovative tools and approaches that could redefine organizational quality management [10]. Integrating advanced technologies such as the Internet of Things, artificial intelligence, and data science into quality management systems could serve as a gateway to the emerging concept of Quality 4.0, which promises to enhance the effectiveness, transparency, and adaptability of quality processes within organizations [11]. However, a low level of digital skills development has been identified as the main barrier to transforming quality management systems, followed by the erosion of quality culture and the presence of obsolete systems that hinder the transition to modern and efficient methodologies [12]. As evidenced, there is a significant challenge in the sustainable implementation of quality management systems (QMS) supported by knowledge management processes and digital industry tools. The gap between quality practices and their effective implementation raises multiple questions [13].

In this context, the need to evolve the quality management systems currently used by organizations becomes evident, adapting them to the new demands of the environment. This transformation requires the adoption of new knowledge, which necessitates the development of capabilities focused on the identification and transformation of knowledge, specifically dynamic absorption capacities. Thus, the question formulated to guide this research was:

RQ: Is there a relationship between the development of dynamic absorption capacities and the maturity level of its quality management system?

2. Theoretical Framework

2.1 Organizational capabilities

An organizational capability can be defined as the configuration of routines and resources that enables an organization to achieve its objectives [14]. This capability is reflected in activities that produce results important for the survival of the organization and prosperity [15,16]. In this sense, organizational capability is understood as an ability to efficiently carry out internal activities [17]. Organizational capabilities are key to acquiring new information, knowledge, and skills that support the competitive advantage. [18]. Furthermore, as capabilities become repetitive, they transform into organizational memory and constitute routines. Organizations gain advantages when they develop appropriate routines that allow them to achieve their objectives through the efficient use of resources [19].

Organizational capabilities arise when a company combines the competencies and skills of its employees, facilitating teamwork and thus transforming their technical knowledge into tangible results [20,21]. In this way, capabilities emerge from the collective learning of the organization, particularly those related to the coordination of production techniques and the integration of technologies [22]. On the other hand, a company's capabilities are strengthened through its internal routines and a formal learning process, which is considered a key factor for the organization to fulfill its productive tasks and ensure its survival [23].

Consequently, capabilities emerge from learning, resources, and organizational history [24]. Companies must develop their organizational capabilities to improve performance and face the complexity and turbulence of markets. These capabilities are essential for creating and maintaining a sustainable competitive advantage in highly dynamic business environments, characterized by a wide dispersion of organizational sources of innovation and production [25].

From the perspective of business growth, Penrose [26] argues that the key lies in the control and efficient use of resources to generate differentiation and achieve a competitive advantage. Tangible and intangible assets are essential for strengthening its capacity for adaptation, innovation, and growth in a dynamic business environment [27]. However, resources alone are not sufficient to achieve business growth; it is the organizational skills and capabilities that emerge from the interaction of these resources that drive such growth. These organizational skills are developed through continuous learning and adaptation over time [28].

Therefore, resources define the boundaries and structure of the organization, and their uneven distribution creates significant differences in capabilities and competitive

strategies. This diversity motivates organizations to seek competitive advantages based on specific resources that are valuable, rare, difficult to imitate, and that can be effectively leveraged to achieve their strategic objectives [29].

2.2 Dynamic Capabilities

Dynamic capabilities are defined as the organizational and strategic routines that managers use to modify the resource base of their companies. This is achieved through the acquisition, elimination, integration, and recombination of resources to generate new assets that create value [30]. A business capability can be understood as a set of activities that use productive resources to create products and services. These capabilities can be classified into two kinds: ordinary and dynamic. Ordinary capabilities refer to the performance of administrative, operational, and governance functions necessary to carry out routine tasks. On the other hand, dynamic capabilities involve high-level activities that allow the company to direct its ordinary activities toward high-performance efforts, especially in rapidly changing environments [31].

Consequently, dynamic capabilities are the skills that companies develop to integrate, build, and reconfigure their resources, adapting to rapidly changing environments [32]. These capabilities define how easily organizations achieve new and innovative forms of competitive advantage. Dynamic capabilities allow companies to renew their resources as needed to innovate and respond to environmental changes [33]. Furthermore, the connection between continuous learning, knowledge sharing, and integration is essential for business success and the internal functioning of the organization [34]. In conclusion, capabilities are configurations of routines and resources, while dynamic capabilities reflect a company's ability to reconfigure its capabilities and adapt to its environment [35].

2.3 Absorption capacities

Absorptive capacities have been used to explain the cognitive structures and knowledge retention in individuals and firms [36]. A dynamic absorptive capacity can be defined as the company's ability to recognize, assimilate, and apply new knowledge [37]. Absorptive capacities recognize the value of new information and its application to improve organizational performance, primarily through innovation [38]. Absorptive capacity is a capability that the firm develops over time through the accumulation of a relevant knowledge base. The assimilation process is influenced by the tacit knowledge the company has regarding the established systems for processing knowledge [39].

In this sense, Mowery and Oxley [40] define absorptive capacity as a broad set of skills for managing and applying transferred tacit knowledge, as well as the frequent need to modify external knowledge to adapt it to specific contexts. It is not just about acquiring knowledge, but also about managing its tacit nature, which involves an active process of interpretation and adaptation to maximize its value within the organization [41].

Therefore, absorptive capacity requires the ability to learn and solve problems. In this way, learning capacity reflects how easily a company understands and assimilates new knowledge [42]. Similarly, problem-solving capacity involves the ability to generate new knowledge that enables the company to innovate [43]. Organizations that foster continuous learning and promote a culture of problem-solving can improve both their performance and organizational effectiveness [44].

2.4 Dynamic absorption capacities

Absorptive capacity can be understood as a dynamic capability, encompassing a set of skills that an organization needs to manage knowledge and create value. This set includes the acquisition, assimilation, transformation, and exploitation of knowledge [45]. In this sense, they can be classified into potential absorptive capacity and realized absorptive capacity. Potential capacity encompasses the acquisition and assimilation of knowledge through the reconfiguration of the resource base and the deployment of capabilities, while realized capacity focuses on its transformation and exploitation through the development of new products and processes. Both capacities, potential and realized, complement each other to generate a positive effect on the organization's competitive advantage [46].

Within the model proposed by Zahra and George [45], four factors are identified: triggers of activation, mechanisms of social integration, and appropriability regimes. Triggers of activation are situational factors that influence the capacities of a company and intention to utilize acquired knowledge. On the other hand, mechanisms of social integration help reduce barriers between assimilation and transformation, thereby increasing absorptive capacity. Finally, appropriability regimes refer to the different systems or mechanisms that an organization uses to control and benefit from the acquired knowledge [47].

In conclusion, potential dynamic absorptive capacities represent the integration of external knowledge into a company's knowledge repository, while realized dynamic absorptive capacities refer to its combination, utilization, and application. Value creation is considered a dependent variable of dynamic capability [48].

2.5 Quality management systems

Quality has become a key component that supports organizations in their pursuit of increasing competitiveness through performance improvement [49]. Quality is considered one of the most effective approaches to optimizing organizational outcomes [50]. Quality management stands out as one of the most significant advancements in the business realm because it not only contributes to performance improvement but also drives the generation of competitive advantages and plays a crucial role in the survival of organizations [51]. Additionally, the rapid expansion of quality management systems has emerged as a response to environmental challenges and greater attention to issues of planning, assurance, control, and quality improvement [52]. Table 1 shows the concept of quality.

Quality management has undergone significant evolution in the last century, considerably expanding its scope in business implementation [58,59]. As a result, the term "total quality management" was adopted, which has been used for approximately a century in productivity generation, statistical quality control, and the application of techniques aimed at improving the quality of products and services [60]. Total quality management has evolved over the past few decades to become one of the most widespread management approaches that support the improvement of products, services, and processes to achieve greater organizational competitiveness [61]. Table 2 shows the evolution of quality management.

Based on the consulted authors, organizational maturity can be defined as a pathway to achieve continuous process improvement, where at each stage, the appropriation of a series of knowledge and the development of certain capabilities are highlighted [66]. In this sense, maturity is related to an organization's ability to consistently implement good quality practices, aligning strategy, culture, and organizational structure [67]. Furthermore, organizational maturity is characterized by promoting a culture of innovation that fosters an environment of creativity and adaptability to change [68]. The integration of processes and technology positively impacts the efficiency and responsiveness of organizations [69].

In accordance with the theoretical framework presented, the research hypotheses are proposed, relating the potential and realized dynamic capabilities of absorption with the maturity level of quality management systems. Fig. 1 shows the relationships between the identified variables and the research hypotheses:

Table 1.
The concept of quality.

Author	Concept
Walter A. Shewhart	Quality consists of two elements: a subjective one that reflects the expectations and desires of the customer, and an objective one that refers to the fulfillment of the physical properties of goods and services.
Edwards Deming	Quality is everything that the consumer needs and wants. Since these needs and desires are constantly evolving, it is essential to continuously redefine quality criteria based on the consumer.
Joseph Juran	Quality refers to the suitability of a product for use. In this sense, it implies the absence of deficiencies in the characteristics that satisfy the customer.
Kaoru Ishikawa	Quality is part of the education of individuals and managers in companies.
Philip Crosby	Quality is defined as meeting established requirements, emphasizing that the only acceptable performance standard is to achieve zero defects.
Armand Feigenbaum	Quality is a corporate way of life, a way of managing an organization. The concept of quality involves planning and control. From this, it proposes the creation of a quality system to provide technical and managerial procedures that ensure customer satisfaction.
American Society for Quality (ASQ)	In the technical realm, quality can have two main meanings: the characteristics of a product or service that affect its ability to meet explicit or implicit needs, and the absence of defects in a product or service.
ISO 9000:2015	Quality is the degree to which a set of inherent characteristics of an object meets the requirements.

Source: The authors adapted from [53-57]

Table 2.
Evolution of quality management.

Period	Authors	Concept
Inspection	Radford	The detection of defective products is carried out through the active search for potential imperfections. This practice formally links inspection with the concept of quality and is considered a direct responsibility of management.
Statistical Quality Control	Walter A. Shewhart W. Edwards Deming	Productivity improves by reducing variation, using techniques such as statistical quality control. This includes the application of control charts and scientific thinking through the dissemination of the PDCA cycle (Plan, Do, Check, Act). In 1951, JUSE established the Deming Quality Awards, which over time became a strong incentive for improvement.
Quality Assurance / Total Quality Control	Joseph Juran Kaoru Ishikawa Philip B. Crosby	The concept of quality evolved from a narrow, manufacturing-focused perspective to an intervention in quality efforts in areas such as design, engineering, planning, and service activities. The concept of quality costs began to be introduced, providing a powerful economic foundation for the quality movement. Quality circles were formalized to train supervisors and workers. The zero defects approach was created, emphasizing quality as a matter of motivation and expectations.
Total Quality Management	W. Edwards Deming ISO	The principles on which an organization's management should be based to continuously improve its competitiveness are presented. The ISO 9000 series of standards emerged, aiming to unify and standardize the different approaches to quality assurance systems that existed up to that point.
Strategic Quality Management	Motorola ASQ EFQM	The Six Sigma (6σ) methodology began to be implemented, and in the United States, the Malcolm Baldrige Quality Award was established by government decree. The EFQM Quality Awards were also established.

Source: The authors adapted from **[62-65]**

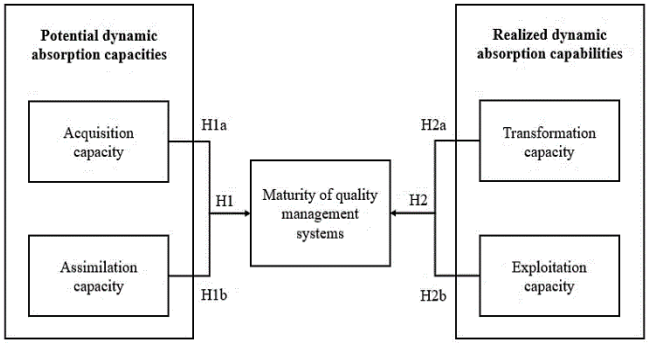

Figure 1. Conceptual model.
Source: The authors.

H1a. The dynamic capability of acquisition is positively related to the maturity of quality management systems.

H1b. The dynamic capability of assimilation is positively related to the maturity of quality management systems.

H2a. The dynamic capability of transformation is positively related to the maturity of quality management systems.

H2b. The dynamic capability of exploitation is positively related to the maturity of quality management systems.

3. Methodology

This research was descriptive, qualitative, non-experimental, hypothetical, and deductive [70]. A non-probabilistic convenience sample of 100 quality leaders from companies located in the city of Bogotá – Colombia, classified in sectors such as construction, technology, industry, finance and health were selected. Minimum experience of 5 years leading quality management system was required. The selected quality leaders were contacted via email. The data collection method was through an electronic form. Table 3 shows the main characteristics of the sample.

Based on the five variables identified in the theoretical framework (acquisition, assimilation, transformation, exploitation, and maturity) a customized survey was designed, consisting of 25 questions grouped into 5 sections, along with 5 control questions. A 5-point Likert scale was used to collect responses: (1) Totally disagree, (2) Disagree, (3) Neither agree nor disagree, (4) Agree, (5) Totally agree. Subsequently, to validate the survey, a pilot test was conducted with a subgroup of 7 quality management system leaders. The data collected yielded a Cronbach's Alpha index of 0.897, indicating a high reliability of the data.

Table 3.
Characteristics of the sample.

Topic	Description
Number of quality management system (QMS) leaders surveyed (sample size)	100
Data collection period	June to December 2023
Position of the respondents surveyed	Managers, directors, coordinators, and auditors of QMS
Average years of experience of quality management leaders	8.5 years
QMS leaders surveyed from the construction sector	24
QMS leaders surveyed from the technology sector	19
QMS leaders surveyed from the industry sector	37
QMS leaders surveyed from the finance sector	17
QMS leaders surveyed from the health sector	3
Companies with certified QMS	100
Average age of QMS	7 years
Average number of members in quality management teams.	3.7

Source: The authors.

The processing of the collected data was carried out in three stages: (1) through a correlational analysis, the existing bivariate relationships between the variables studied were identified, (2) using an exploratory factor analysis, the underlying structure of the indicators that make up the selected variables, (3) finally, the research hypotheses were contrasted using a structural equation model.

4. Results

The results obtained in each of the proposed stages are presented below:

4.1 Correlational analysis

To understand the relationship between dynamic absorption capacities, potential and realized, and the maturity of quality management systems, the Pearson correlation coefficient was calculated. Table 4 shows the results obtained.

As shown in Table 4, the dynamic absorption capacity for acquisition is positively related to the maturity of quality management systems (0.85). In this sense, the dynamic absorption capacity for assimilation is also positively related to the maturity of quality management systems (0.83). Similarly, the dynamic absorption capacity for transformation shows a positive relationship with the maturity of quality management systems (0.87). Finally, the dynamic absorption capacity for exploitation has a positive relationship with the maturity of quality management systems (0.86). These results suggest preliminarily that dynamic absorption capacities positively explain the maturity of quality management systems.

4.2 Exploratory factor analysis

As a second step for data processing, exploratory factor analysis using the principal components method was utilized. This method allowed for the validation of the items included in the survey and determined whether they measured the variables proposed in the conceptual model. Additionally, the method also allowed for the evaluation of the causal relationships needed to apply the structural equation modeling in the third step [71]. Table 5 shows the results obtained.

As shown in Table 5, the correlation levels between the studied variables are above 0.83 and can be classified as high. Likewise, the result obtained in the determinants is close to0, ensuring the correct aggregation of the repeated data,

Table 4.
Pearson correlation coefficient results.

Variable	Acquisition	Assimilation	Transformation	Exploitation	Maturity QMS
Acquisition	1				
Assimilation	0.82	1			
Transformation	0,87	0,83	1		
Exploitation	0.79	0,80	0,82	1	
Maturity qms	0.85	0,83	0,87	0,86	1

Source: The authors.

Table 5.
Exploratory factor analysis.

Variable	acquisition	assimilation	transformation	exploitation	maturity QMS
Correlation	0,83	0,85	0,88	0,87	0,84
Level of Correlation	High	High	High	High	High
P Value	0.000	0.000	0.000	0.000	0.000
Determinant	0.007	0.005	0.003	0.005	0.008
Communality	>0.81	>0.83	>0.85	>0.81	>0.87
Level of communality	Good	Good	Good	Good	Good
Kmo	0.901	0.899	0.877	0.875	0.912
Bartlett	0.000	0.000	0.000	0.000	0.000
Cronbach alpha	0,917	0,931	0,899	0,889	0,952
Cri	0,954	0,923	0,911	0,899	0,932

Source: The authors.

which is a positive outcome for the research. In turn, the result obtained in the calculation of the communalities of the studied variables has values close to 0, which is interpreted as low variability for each of the studied factors. In the case of the KMO test, the results for each of the variables are close to 1, showing a balance between the observed correlation coefficients and the partial correlation coefficients. In this regard, Bartlett's test of sphericity shows a positive and significant relationship between each of the studied latent variables. Finally, the reliability of the collected data was validated through Cronbach's alpha and the Composite Reliability Index (CRI). Each of the studied variables obtained values above 0.7, thus ensuring the consistency of the data.

4.3 Structural equation model

As a first step to test the research hypotheses, the statistical fit of the conceptual model proposed in Fig. 1 was calculated. To calculate the degrees of freedom of the model, the chi-square index (CSI), root mean square error of approximation (RMSEA), comparative fit index (CFI), and incremental fit index (IFI) were used. The obtained results show that the proposed model exhibits a good statistical adjustment. According to the obtained data, the chi-square index (CSI) is double the degree of freedom. Additionally, the root mean square error of approximation (RMSEA) is close to 0. In this regard, the comparative fit index (CFI) and the incremental fit index (IFI) are greater than 0.9. Table 6 shows the obtained results.

Table 6.
statistical adjustment

Index	Expected value	Calculated value	Adjustment
CSI	Double the degrees of freedom	CSI: 1533 DF: 517	Acceptable
RMSEA	0,05< and >0,08	0,017	Acceptable
CFI	0,90 to 1	0,917	Acceptable
IFI	0,90 to 1	0,923	Acceptable

Source: The authors.

Table 7.
Validation of hypotheses.

RH	Relationship	EI	ME	CR	P	Decision
H1a	Acquisition - Maturity	0,83	0,11	2,2	0.00	Accepted
H1b	Assimilation - Maturity	0,88	0,15	2,5	0.00	Accepted
H2a	Transformation - Maturity	0,81	0,22	2,7	0.00	Accepted
H2b	Exploitation - Maturity	0,84	0,17	2,9	0.01	Accepted

Source: The authors.

On the other hand, several statistical models were used to validate the research hypotheses. The first was the effect index (EI) to assess the magnitude and direction of the relationship between two variables. The second was the measurement error (ME) to identify whether there is any difference between the obtained value and the estimated value. The third model used was the critical ratio (CR) to determine the inferential representativeness of the bivariate relationships of the studied variables. Finally, Fisher's significance model (P) was used to confirm the validity of the hypotheses. Table 7 shows the obtained results.

As seen in Table 7, there is a positive relationship between the studied variables: dynamic capabilities of absorption, assimilation, transformation, and exploitation, and the maturity level of quality management systems. Firstly, the effect size index is classified as *large* [72], which highlights that the dynamic capabilities of absorption have a significant effect on the maturity level of quality management systems. In this regard, the measurement error results are relatively *low*. Finally, the critical ratio index and the p-value show a positive, directly proportional relationship between the studied variables, which allows for the empirical validation of the proposed hypotheses and acceptance of their interdependence. Fig. 2 presents the proposed structural model.

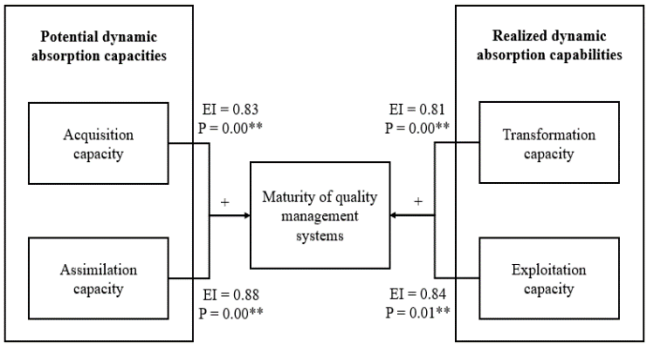

Figure 2. Structural model.
Source: The authors. **P<0.05

5. Discussion

Based on the results obtained, a strong correlation is observed between the processes of knowledge appropriation

and the maturity index in organizational management. This conclusion aligns with the studies of Zhang [73], which indicate that effective knowledge management can enhance decision-making, foster innovation, and increase operational efficiency, thereby enabling organizations to better adapt to their environment and improve competitiveness. Todorova [74] complements this idea by pointing out that effective knowledge management is essential for organizations to develop dynamic capabilities that enhance their performance. Absorptive capacity involves not only the acquisition and assimilation of knowledge but also the transformation and exploitation of that knowledge within the organization.

In relation to organizational maturity, De Bruin [75] connects it with continuous improvement processes and the adaptability of companies. A structured approach to organizational maturity enables organizations to identify their opportunities for improvement, adopt best practices more effectively, and optimize their performance. Mature organizations are open to change and innovation, allowing them to respond effectively to the needs of their environment. This viewpoint aligns with that of Goetsch [76], who emphasizes the maturity of quality management systems as a mechanism to enhance organizational performance. A mature quality management system allows organizations to adapt to environmental needs and acquire the necessary knowledge to improve efficiency and effectiveness, significantly contributing to competitiveness through a culture of continuous improvement.

In addition to the previous paragraph, Chiarini [77] argues that dynamic capabilities enable organizations to maintain their quality management systems while also evolving and continuously improving in response to environmental changes. Organizations that mature their dynamic capabilities are more sustainable and effective in implementing good quality management practices. De Silva [78] emphasizes that dynamic capabilities are key to organizational development through effective quality management systems that facilitate adaptation to environmental changes and emerging market needs. Therefore, the organizational development of absorptive dynamic capabilities positively impacts the maturity of quality management systems, with knowledge management processes serving as a reliable source of differentiation for companies [79-82]. Although the surveyed leaders work in companies from different sectors and sizes, and their quality management systems exhibit various degrees of maturity, a direct relationship can be observed between the efforts made by top management to acquire and appropriate knowledge, and the level of quality achieved in the management of their processes, as well as in the development of their products and services. Economic growth is positively related to the ability to adequately manage knowledge.

6. Conclusions

Through this study, significant evidence was presented that absorptive dynamic capabilities are positively related to the maturity index of quality management systems. This conclusion is based on the collected data and the applied statistics, and the results align with the arguments put forth by several authors. In this regard, knowledge management processes are highlighted as a clear source of organizational differentiation. The proposed hypotheses were validated, achieving a high level of significance between the studied variables.

Under the organizational dynamic capabilities approach, absorptive capabilities are emphasized for their ability to capture knowledge and adapt it to the specific needs of each company. This process requires an organizational culture focused on innovation and continuous improvement, where human talent is the key factor for achieving transformation. The dynamic nature of these capabilities is characterized by the permanent changes in the current environment, which demand continuous learning from workers and an objective understanding of the realities of organizations and their environment.

Quality management systems are mechanisms to ensure organizational effectiveness. In this regard, they must be flexible and capable of responding to the needs arising from constant change. Quality management systems should evolve alongside organizations, which is achievable if knowledge also transforms and is transferred effectively. A static quality management system loses its meaning and organizational value. Quality assets are what allow the generation of a competitive advantage; in this case, knowledge is the primary quality asset. Promoting the development and transformation of absorptive capabilities within companies ensures, to some extent, the evolution of knowledge.

Strengthening dynamic absorption capabilities will enable organizations to improve the maturity of their quality management systems. To achieve this, it is essential to define concrete actions focused on promoting continuous learning, organizational flexibility, and collaborative work. It is crucial to identify and value the new knowledge emerging from technological, economic, social, and cultural trends, thus preparing human talent to adopt it for the benefit of organizational maturity and the appropriation of best practices. In this regard, leadership, teamwork, and effective communication are key pillars of a coherent knowledge management model. Strengthening relationships with market-leading companies will provide access to valuable knowledge; however, workers must be able to absorb and apply it for the benefit of the organization. Human talent is the fundamental driver of economic and social development.

Finally, in the second phase of this research, a more detailed analysis is expected to be developed in a specific sector, incorporating a larger sample of quality leaders, which will allow for balancing the proposed model. Additionally, as a case study, the obtained results will be documented and compared with the previously presented ones. This will enable the necessary adjustments to be made and the research results to mature.

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Social network addictions and their impact on work productivity and academic performance

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Abstract
The increasing penetration of online social networks (OSNs) and smartphones, particularly among young people, raises questions about their effects on academic performance and workplace productivity. This research aimed to assess the degree of addiction, gender differences, and the relationship between addiction to OSNs and smartphones, as well as discrepancies in perceptions among students, teachers, and academic directors. A mixed-methods design was employed, including in-depth interviews and questionnaires validated in Spanish, surveying 88 faculty members and 461 undergraduate students in Buenos Aires. The results indicate that academic directors believe excessive use of OSNs distracts and decreases productivity. Although they do not see the need for regulation, there is consensus on the crucial role of teachers. Faculty members report concentration problems in students, and a correlation is observed between addiction to smartphones and OSNs, with higher levels of addiction found among women.

Keywords: project management; online social network; labor productivity; academic performance; addiction.

Adicciones a las redes sociales y su impacto en la productividad laboral y el rendimiento académico

Resumen
La creciente penetración de redes sociales online (RSO) y smartphones, especialmente entre jóvenes, plantea interrogantes sobre sus efectos en el rendimiento académico y la productividad laboral. Esta investigación tuvo como objetivos evaluar el grado de adicción, las diferencias de género y la relación entre la adicción a las RSO y smartphones, así como las discrepancias en las percepciones de alumnos, profesores y directores académicos. Se empleó un diseño metodológico mixto incluyendo entrevistas en profundidad y cuestionarios validados en español, encuestando a 88 docentes y 461 estudiantes de pregrado en Buenos Aires. Los resultados indican que los directivos académicos consideran que el uso excesivo de las RSO distrae y disminuye la productividad. Aunque no ven necesaria una regulación, coinciden en el papel crucial del docente. Estos reportan problemas de concentración en estudiantes, y se observa una correlación entre la adicción a smartphones y RSO, con mayores niveles de adicción en mujeres.

Palabras clave: gestión de proyectos; redes sociales online; productividad laboral; rendimiento académico; adicción.

1 Introduction

Since its inception, online social networks (OSN) have grown exponentially, with new and varied platforms emerging, with users from all over the world [1]. By 2024, nearly 5,22 billion people worldwide are active on social media, with the average user spending 2 hours and 23 minutes daily on these platforms [2,3] Numerous studies show that young people are the most likely to use OSN [4]. In addition, this growth in OSN was accompanied by a significant increase in the average time that people spend in these interaction spaces [5], opening new questions regarding user behavior and its consequences [6,7], due to the addictive behavior/problematic use that these networks encourage [8-10].

While numerous studies highlight the benefits that came with the use of OSN [11-15] there is also a dark side: individual and social costs can be identified [8,11,16-21]. Previous research has observed heterogeneous effects (positive and negative) on academic performance [22] and work productivity with the use of OSN [23], highlighting the

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need for further research on the topic [9]. In fact, previous researchers emphasized the importance of adding qualitative analysis [24] and the need to find a common instrument to compare different sampled results [25].

Consequently, this article introduces, not only a new sample to compare results with previous research which used the same instruments [16,21,26,27], but also it contributes to a further and deeper comprehension of OSN' impact in academic and work productivity, since incorporates the vision of teachers and academic managers in addition to the student's vision of their own behavior. This allows to visualize if there are any differences between the perception that under degree students have, to their teachers and academic managers perception, regarding the effect of OSN and smartphones on academic and work performance. This is not a minor issue since part of the differences in the results observed from previous research are associated with different types of performance measurement: while there are instruments that measure self-perception of the student or worker who is being surveyed [15,28,29]; other instruments use hard indicators of academic and work performance such as grades or performance evaluations [30,31].

In this way, this research seeks to better understand the effects that OSN and smartphone have on the academic and work performance of young university students, having set the following objectives:

- To contribute to a better understanding about if there are any differences between the perception of students, users of OSN and smartphones and teachers and academic managers vision of their student's behavior.
- To know the degree of addiction to OSN and smartphones (understanding the latter as a tool to access OSN), in undergraduate students from Buenos Aires.
- To analyze whether there are gender differences in the behavior of young undergraduate students regarding OSN and smartphone addiction patterns.
- To analyze the relationship between addiction to social networks and smartphone addiction.

With this, we formulate the hypothesis which follows:

- H1: There are different perceptions between students, teachers and academic managers about OSN and smartphone optimal rate of use and its consequences in academic performance and work productivity.
- H2: Undergraduate students present high grades of addiction to OSN and smartphone.
- H3: Women are more prone to be addicted to OSN and smartphones.
- H4: There is a strong correlation among OSN addiction and smartphone addiction.

2 Methodology

This research non-experimental descriptive correlational and cross-sectional nature, with mixed qualitative-quantitative design, used in-depth interviews plus 3 questionnaires. Eleven in-depth interviews, guided by semi-structured questions, were made to academic managers.

Furthermore, a sample of 88 teachers were surveyed with an online questionnaire elaborated with the purpose of contributing to understand the differences that may exist between student and teachers' perception about OSN and smartphone optimal rate of use and its consequences in academic performance and work productivity. In addition, to know students' degree of addiction to OSN and the use of smartphones, 2 other instruments were used with a 461 student sample of a university of Buenos Aires: 1) Social Media Addiction Scale-Student Form (SMAS-SF; Sahin, 2018) [32]: Spanish version adapted by Cabero Almenara et al. (2020) [26] and 2) Smartphone Addiction Scale-Short version for adolescents(SAS-SV; Kwon et al., 2013) [33]: Spanish version adapted by López-Fernandez (2015) [34]. SMAS-SF instrument is 5-point Likert type scale of 29 items grouped in 4 factors (virtual tolerance, virtual communication, virtual problem and virtual information). SAS-SV is self-diagnostic scale of 33 item scales grouped in 6 factors (daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse and tolerance).

Before completing the survey and being interviewed, the respondents gave their consent having been informed of the procedure and characteristics of the research and data processing. Participation was voluntary, and respondents were accessed online for the surveys from the databases provided by the university that finance under D23E02 code this research project. Ethical approval was obtained from the university as well.

The surveys were carried out between November 2023 and February 2024.

The sample contained 551 respondents (students, teachers and academic managers of a university of Buenos Aires). From those, 5 were rejected for being minors or for not having completed the questionnaire with valid data, thus leaving a sample of 546 people, of which 461 (84%) of them were students (283 women and 178 men; 225 (49%) only study and 236 (51%) work and study). Furthermore, the sample contains 84 university professors (43% women and 57% men), with 13% of these that also were academic managers. The sampling was non-probabilistic, for convenience [35]. 86% were residents at Buenos Aires AMBA region, 11% resided in other locations in the province of Buenos Aires and only 3% from the rest of the country. Ages range were as follows: 18 to 71 years, with an average of 27 years (SD = 11.174) for all the sample, 18 to 71 years, with an average of 24 years (SD=8.900) for students, 24 to 67 years, with an average of 44 years (SD=11.081) for teachers. 72% of the sample do not have a complete university degree and the students, on average, take 4.42 subjects (SD=2.059) and have approved 3.95 (SD=2.154) subjects per semester.

The analysis was carried out with SPSS 27 software and descriptive statistics were used for objective number 2, mean deviation, minimum and maximum. For objective number 3, a Student's T was performed and for objective number 4, a Pearson correlation was performed.

3 Results

From the in-depth interviews carried out with academic managers, there is a consensus that there is excessive use of online social networks, with distraction problems associated with this. Most agree that social networks have their benefits, when they are used to obtain and make information available,

to generate collaborative environments, shortening distances, fostering links and communicating. However, there is a consensus that, if these networks are not used appropriately, they lead to losses in productivity, both academic and work-related, because of the distractions they generate for students and workers. Regarding whether they consider it appropriate to establish a standard from universities to regulate the use of social networks, the majority say they do not agree with establishing a standard but instead encourage education and awareness campaigns that misuse of networks can generate.

There are several managers who affirm that it is the responsibility of the teacher in the classroom to generate sufficient interest and motivation in the students so that they are not distracted by the smartphone. Regarding whether they consider that the impact on academic/work performance depends on the user's profile, or the type of social network used, the majority believe that the profile is more important, although they do not rule out that there are differences in the types of networks which may make some of them less productive than others.

From the questions asked to the teachers who participated in the survey, the following results stand out:

- 70% affirm that their university students, due to the use of smartphones and ONS, have had concentration problems in class, during class or while doing their homework.
- 54% agreed that smartphone and OSN use has addictive behavioral traits that decrease the academic performance of university students.
- 20% indicated having tried to ensure that their university students do not use their smartphone in class for uses other than the proposed activities, finding it impossible.
- 59% stated that their students are constantly checking their smartphone and OSN for recreational purposes, even during class.
- 31% say that their students prefer class activities in which they must use smartphone and OSN rather than working on paper or another format.
- 53% of teachers believe that the use of smartphones and OSN in the classroom should be something that university teachers could allow or deny.

When comparing the perceptions of teachers and students, the following agreements and differences can be remarked:

- Both teachers and students recognize the loss in productivity as a result of the use of social networks.
- While 54% of teachers agreed that smartphones and OSN use have addictive behavioral traits, only 36% of the students recognize feeling impatient and restless when they don't have their smartphone. Despite this, only 20% of teachers indicated that they had tried to prevent their university students from using their smartphone in class for uses other than the proposed activities, finding it imposible. This could reinformce the idea that teachers still have power to enforce the rules in class. In fact, 74% of students say they disagree that they would feel bad if they were forced to reduce the time, they spend on OSN.
- While 59% of teachers stated that their students constantly check their smartphone and OSN for recreational purposes, even during class, only 37% of the students recognize being constantly checking your phone so you don't miss conversations with other people on social media.

The results of the adapted questionnaires of the SMAS-SF and SAS-SV show that women had a higher average in the descriptive analysis. A student's T test was performed to analyze whether these differences were significant according to gender (See Table 1 and 2).

Table 1.
Gender differences in Social Media Addiction Scale-Student Form (SMAS-SF; Sahin, 2018) [32]: Spanish version adapted by Cabero Almenara et al. (2020) [26] - T student.[1]

	Men N=165 M (SD)	**Women N=295 M (SD)**	**T (461)**	**p**
Satisfaction with being connected to OSN	13.9030 (4.46698)	14.5201 (4.58675)	1.399	.162
Problems	10.3455 (3,61679)	11.0772 (3.56716)	2.103	.036
Obsession with being informed	18.9394 (4,74560)	19,1074 (4.16599)	0.395	.693
Need/Obsession to be connected	18.200 (5,67321)	20,7181 (4.97750)	4.956	.000
Social Media Addiction	61.3293 (15.47382)	65.4381 (13.49019)	-2.989	003

Source: Own calculations

Table 2.
Gender differences in Smartphone Addiction Scale-Short version for adolescents (SAS-SV; Kwon et al., 2013) [33]: Spanish version adapted by López-Fernandez (2015) [34] – T student.[2]

	Men N=165 M (SD)	**Women N=295 M (SD)**	**t (461)**	**p**
Smartphone Addiction	28.7939 (7.95835)	30.8926 (7.31553)	2.864	.004

Source: Own calculations

Table 3.
Correlations between the 2 instruments: Social Media Addiction Scale-Student Form (SMAS-SF; Sahin, 2018) [32]: Spanish version adapted by Cabero Almenara et al. (2020) [26] and 2) Smartphone Addiction Scale-Short version for adolescents (SAS-SV; Kwon et al., 2013) [33]: Spanish version adapted by López-Fernandez (2015) [34].[3]

	Social Media Addiction [26]			
	Satisfaction with being connected to OSN	**Problems**	**Obsession with being informed**	**Need/Obsession to be connected**
Smartphone Addiction [34]	.468**	.599**	.528**	.654**

** Significant correlation at the p<.001 level.
Source: Own calculations

[1] The values in this table are not in percentages. Instead, they are in units of the SMAS-SF questionnaire measurement scale.

[2] The values in this table are not in percentages. Instead, they are in units of the Smartphone Addiction Scale-Short version (SAS-SV) questionnaire measurement scale.

[3] The values in this table are correlation coefficients.

When comparing our results with those obtained by previous research that worked with samples from other countries, using the same measurement instruments, the following differences are observed: While the results of our study show on the adapted SMAS-SF scale higher scores in women than in men, in the following 2 factors: “Problems and “Need/obsession to be connected, (See Table 1), with alevel of significance ($p<.01$); The same does not occur in the results obtained by [26] where men register higher scores in the factors, “Satisfaction with being connected to online social networks and “Problems.

On the other hand, a strong correlation is seen between addiction to the smartphone and the different factors thatmeasure addiction to OSN, such as, "satisfaction for being connected to online social networks", "problems", " the obsession to be informed and “the need/obsession to be connected. In particular, the dimension “Need/Obsession to be connected presents the highest correlation with smartphone addiction ($r=.65$, $p<.001$). (See Table 3: Correlations between the 2 instruments: Social Media Addiction Scale-Student Form (SMAS-SF; Sahin, 2018) [32]: Spanish version adapted by Cabero Almenara et al. (2020) [26] and 2) Smartphone Addiction Scale-Short version for adolescents (SAS-SV; Kwon et al., 2013) [33]: Spanish version adapted by López-Fernandez (2015) [34]).

With all these results it could be concluded that H1, H2, H3 and H4 are fulfilled.

4 Conclusions

The results obtained were conclusive with respect to the proposed hypotheses. With respect to H1, the findings were that students, teachers and academic managers all found that there exists an overuse of OSN and smartphone, higher than the optimal rate of use and the majority believe this could represent a threat to academic performance and work productivity. With respect to H2, the results show that undergraduate students present high grades of addiction to OSN and smartphone, being women are more prone to be addicted to OSN and smartphones, confirming H3. Furthermore, it was found a strong correlation among OSN addiction and smartphone addiction, as in H4 was postulated.

The differences observed in the perceptions of students and teachers regarding the use of OSN and smartphones suggest that educational institutions, as educators, have the responsibility to guide students not only in their academic education but also in addiction prevention. This aligns with the findings of [36], a study that, using the same SMAS-SF scale, also identified differing perceptions between teachers and students and recommended preventive policies to address the potential addiction caused by OSN.

Previous research highlights the existence of multiple questionnaires, each measuring different aspects of the issue [9], as one of the challenges in addressing the measurement of the impact of OSN and smartphone use on academic and work performance. Our research showed that the differences aren’t restricted to the different scales problem. In fact, even when the same instruments were used, some results agree and others do not. Comparing our results with [16], in both investigations there is an impression that OSN could be addictive and with a negative impact in the academic performance. But, in [16] women show better academic performance fact that do not match with the higher punctuation in OSN and smartphone addiction that was found in our sample. By the way, [21] remarks that smartphone addiction was associated with self-reported negative effects in work and daily lives productivity. This match with our findings as well, even more if we consider that research found SAS scores for female were higher than for males. According to the recommendation of [27] to contrast student versus teachers’ perceptions regarding OSN addiction, our work contributes to this field, confirming that teachers find students are with an excessive rate of OSN and smartphones’ use. It is in fact from the in-depth interviews with professors and academic directors where it can be observed that there is a certain consensus that a normal or regulation for the use of OSN and smartphone in the educational and work environment can be very difficult to implement, which in turn refers us to the need to find prevention and awareness policies about the effects that misuse of OSNs and smartphones can have on academic and work performance. This leads us to think about previous research that addresses the problem from the perspective of dual decision theories, which assume the existence of two cognitive-emotional systems of the human mind: the impulsive system (automatic) and the reflective system (inhibitory) [37]. In line with this, a recent trend among social media users highlights their increasing awareness of excessive usage, reflected in behaviors aimed at self-regulation [38] and practices such as "digital detoxing" [39]. Future research could further explore this phenomenon through the lens of dual decision theories.

Furthermore, considering the results obtained, which indicate excessive use of smartphones in classrooms, with implications for academic performance, it is pertinent to think about the possible decisions that educational administrators can make. These administrators could choose to prohibit the use of social media and smartphones in the classroom or, alternatively, take advantage of these technologies by incorporating them into the learning process. These debates are currently underway, particularly with the emergence of new technologies such as artificial intelligence. [40] address these types of dilemmas.

One of the findings of this research indicates that teachers believe they should have the authority to enable or prohibit smartphone use in classrooms. Previous studies have explored the advisability of imposing restrictions on smartphone usage in university settings. An insightful study by [41] investigates the opinions of students and faculty regarding four potential policies for smartphone use in the classroom: 1) No Use, 2) Use During Breaks, 3) Use for Academic Purposes, and 4) Laissez-Faire Approach. The study finds that both students and faculty agree that a policy of complete restriction on smartphone use would be the most effective in reducing usage rates and the easiest to enforce, even though students express a preference for greater flexibility. [42,43] evaluate policies prohibiting smartphone use in classrooms, which include penalties for noncompliance. In contrast, [44] examines reward policies for non-use. Future research on the outcomes of various policies implemented by educational institutions regarding

smartphone use in classrooms could be particularly valuable and illuminating in this emerging debate.

Perhaps an alternative way, and in tune with what has been observed in interviews with teachers and the academic managers, could be to establish an institutional policy for educational institutions, in which it is the teacher who has the power to authorize or deny the use of the smartphone in the classroom. This would allow the teacher to think of classroom strategies that allow him to combine the desire to be connected and informed that university students manifest, with the advantages offered by new technologies of providing easy access to information. After all, as suggested by [45], OSN can have a positive influence on the teaching and learning process, serving as a pedagogical tool in the classroom.

Of course, this must be accompanied by two additional tools: on the one hand, teacher training that the institution must guarantee to have teachers updated with new technologies that promote learning, and on the other hand, strong awareness campaigns for students and teachers of the damage caused by the misuse of smartphones in the classroom when they aren`t used for educational purposes.

In addition, to expand the scope of this research, future studies could focus more on the implications for workplace productivity, incorporating the perspective of agency theory. [46] noted that different work formats can influence employees' alignment with organizational goals. Analyzing the observed differences in performance perceptions, both academic and occupational, through this lens may yield valuable insights.

Regarding the limitations that we found in this work, it can be noted that the correlation found between addiction to OSNs and the smartphone, in some way may constitute a limitation itself, if the smartphone is understood as the vehicle to access OSNs. That said, future research could seek to re-ensure the theoretical separation between OSN and the smartphone. It could even be interesting to separate the analysis according to the type of network. In fact, among the results of the interviews, it was observed that, although the majority believes that the user's profile is decisive to know if he will fall into a higher than optimal rate of use of OSN, there is consent that the type of network can encourage this addiction. It would then be interesting to continue investigating whether it is feasible and recommended to establish some type of regulation that directly impacts those who design OSNs.

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Academic project management: Lean Thinking applied in a higher education department in the city of Puebla, an approach for efficiency and quality

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Abstract
Bureaucracy in university management has led to a concentration of processes and excessive controls, resulting in delays in decision-making and increased workload for academic staff. This organizational complexity creates communication gaps between departments, raising operational costs and compromising customer satisfaction. This study demonstrates that implementing Lean methodology within a university department's project management program yields tangible improvements in response times, reduces operating costs, lowers employee stress levels, and enhances educational service quality. Based on a literature review of higher education management and Lean principles, this research provides practical application in an academic department, with results compared to existing literature. The findings indicate that Lean Thinking facilitates a more effective educational experience by minimizing bottlenecks and redundant processes, enabling the reallocation of human and material resources toward activities that genuinely add value to students.

Keywords: project management; lean thinking; lean management; lean university; academic processes.

Gestión de proyectos académicos: Pensamiento Lean aplicado en un departamento de educación superior en la ciudad de Puebla, un enfoque para la eficiencia y la calidad

Resumen
La burocracia en la gestión universitaria ha conducido a una concentración de procesos y controles excesivos, generando retrasos en la toma de decisiones y un incremento en la carga laboral del personal académico. Esta complejidad crea brechas de comunicación entre departamentos, aumentando los costos operativos y comprometiendo la satisfacción del usuario. Este estudio demuestra que la implementación de la metodología Lean dentro del programa de gestión de un departamento universitario produce mejoras tangibles en los tiempos de respuesta, reduce costos operativos, mejora el ambiente laboral y mejora la calidad de los servicios educativos. Basado en una revisión de literatura sobre gestión de educación superior y principios Lean, esta investigación proporciona una aplicación práctica en un departamento académico. Los hallazgos indican que el Pensamiento Lean facilita una experiencia educativa al minimizar cuellos de botella y procesos redundantes, permitiendo la reasignación de recursos hacia actividades que agregan valor a los estudiantes.

Palabras clave: gestión de proyectos; pensamiento lean; gestión lean; universidad lean; procesos académicos.

1. Introduction

In the realm of higher education, universities face mounting pressures to enhance operational efficiency and service quality [1]. These challenges arise from a confluence of factors: escalating demands, resource constraints, and the need for responsiveness [2]. Unfortunately, traditional bureaucratic structures often impede agility, hindering timely decision-making and effective coordination [3]. As a result, innovative approaches are essential to streamline processes and optimize outcomes.

According to Höfer and Naeve, the implementation of Lean Thinking in academic management processes enables universities to reduce the time spent on administration and

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support services. Moreover, it facilitates a more effective educational experience centered around students by identifying bottlenecks, eliminating redundant processes, and strategically reallocating human and material resources toward academic processes that genuinely enhance student value [4]. Delays in meeting deliverables or instances of complete failure in their delivery often stem not from personnel inefficiencies but rather from inadequately structured, occasionally narrow, and insufficiently systematized processes [4].

This paper delves into the potential of Lean Thinking as a transformative methodology within the context of academic project management [5]. By adopting Lean principles, universities can address these challenges head-on, fostering efficiency, effectiveness, and continuous improvement [6].

Simultaneously, this study addresses the following hypothesis: The implementation of Lean Thinking within a project management model at the Dean's Office of Creative Sciences at UPAEP (Universidad Popular Autónoma del Estado de Puebla) yields several benefits, including enhanced operational efficiency, optimized resource utilization, waste reduction, and improved quality of academic services.

The study begins with a literature review where a brief analysis of relevant articles on the topic of Lean Management in Education is conducted. Subsequently, a bibliometric analysis is carried out using the SCOPUS database, searching for the terms "Education" and "Lean Management," which yielded a list of 900 documents. Upon refining the search, 99 documents applicable to the theme of agile management of educational spaces are obtained. Following this, a search is conducted using the terms "lean" and "Education," resulting in 193 outcomes. This list serves as a reference for the subsequent analysis. The data is then validated, correcting import, spelling, and grammatical errors, to construct tables and graphs that appropriately present the information.

The search conducted spans from 1970 to 2022 to clearly identify research trends on the specific topic. The most significant results obtained from the literature review are summarized as follows:

The application of Lean Management in universities is relatively recent [7] and has its roots in the late 20th century [8] when higher education institutions began recognizing the need for more efficient approaches to address administrative and educational challenges [3]. Despite its proven effectiveness in improving processes and eliminating waste in other industries, awareness and study of Lean management in higher education remain relatively low [7]. However, universities are increasingly facing pressures to adapt to a changing global market with declining student numbers and a wide range of educational offerings [9].

Institutions such as Michigan Technological University (MTU) and Massachusetts Institute of Technology (MIT) have successfully implemented Lean principles to improve administrative processes and enhance student satisfaction [2]. For instance, MTU focused on identifying and eliminating non-value-added activities [3], resulting in streamlined enrollment processes and improved resource management [10]. Similarly, MIT adopted Lean principles across various areas, including project management, quality improvement, and human resources, leading to enhanced efficiency and productivity.

In Mexico, universities like Universidad Autónoma del Estado de México (UAEM) and Universidad Autónoma de Nuevo León (UANL) have begun implementing Lean Six Sigma methodologies to optimize processes and improve the student experience [11]. UAEM's adoption of Lean Six Sigma resulted in reduced administrative processing times and improved accuracy in information management. On the other hand, UANL implemented Value Stream Mapping to visualize workflow and identify areas for improvement, leading to increased efficiency and productivity [12].

These examples highlight the tangible benefits of Lean management in higher education, including improved process efficiency, reduced wait times, and enhanced quality of services [13]. Moreover, the cultivation of a culture of continuous improvement and the provision of training programs have facilitated the successful adoption and sustainability of Lean practices within universities [11].

With the information gathered from the literature review, an exhaustive diagnosis of the current state of the Deanery of Creative Sciences at UPAEP was developed through a combined analysis of quantitative and qualitative data [14], aiming to thoroughly understand the functioning of this Deanery, its organizational climate, the perceptions of its members, and above all, the efficiency of its processes. Through this evaluation process, it is expected that this Deanery can identify areas for improvement, leverage its strengths, and lay the groundwork for continuous growth [15]. The literature review reveals a clear opportunity to integrate manufacturing-derived methodologies into academic processes, particularly in the context of course scheduling and resource allocation. This integration requires a structured framework that addresses the specific challenges of academic environments while maintaining the rigor of established methodologies.

2. Methodology

The methodology outlines the research approach adopted in this study, incorporating both theoretical analysis and practical application [15]. As seen, systematic literature review is conducted to identify key concepts and principles of Lean management applied at universities, followed by a case study approach to implement Lean methodologies within a selected university department. The methodology highlights the iterative nature of the research process, emphasizing data collection, analysis, and reflection. The Qualitative Phase of the research was approached using semi-structured Interviews [16] that were conducted with participants using a previously designed question script. These interviews focused on qualitative aspects related to organizational climate, job satisfaction, interpersonal relationships, leadership, organizational culture, and other relevant topics [17].

- The Quantitative Phase: Institutional Indicator Review: Quantitative data from programs were collected from institutional indicator dashboards available at UPAEP [14]. These indicators include metrics to identify process efficiency, quality, and accuracy of academic activities as a reflection of academic administration.
- Data Analysis: An integrated analysis of qualitative and quantitative data was performed, involving comparison and triangulation to obtain a holistic view of the Deanery's situation [18].

- Interpretation of Results: Findings were interpreted based on the research objectives, identifying the strengths, weaknesses, opportunities, and threats of the Deanery of Creative Sciences.
- Report Development: A diagnostic report was drafted, including a detailed description of findings, conclusions, and recommendations [19].

The analysis and interpretation of qualitative and quantitative data obtained was presented using "ANDON," which, within the context of Kaizen, is considered an essential tool for fostering continuous improvement [20]. By providing a clear visualization of problems through color-coded lights, Andon helps engage collaborators in identifying and solving problems, contributing to the continuous improvement process in the organization [8]. The color-coding system follows a standardized risk assessment approach where red indicates critical indicators falling below acceptable thresholds, representing immediate operational risks that require urgent intervention. Yellow signifies potential medium-term risks (within 1-2 years) if corrective actions are not implemented, while green denotes processes meeting or exceeding performance indicators with no identified risks. This tricolor classification was applied across the six academic programs within UPAEP's Creative Sciences Deanery: Architecture, Advertising, Visual Design and Innovation, Digital Communication and Media, Animation, and Film and Audiovisual Production. This systematic application enables a comprehensive assessment of operational performance across all departments while maintaining consistency in risk evaluation and visualization principles as shown in Fig. 1 below. [21]

The image summarizes the status of the deanery, presenting the six schools that comprise it and the five strategic aspects that were measured, providing a general overview of the areas of opportunity.

As can be observed, the area requiring the most attention is related to management processes, as the semaphore is yellow in 3 out of the 6 programs, implying short-term attention, and red in another 3 programs, necessitating immediate action. This makes this area an opportunity common to all programs.

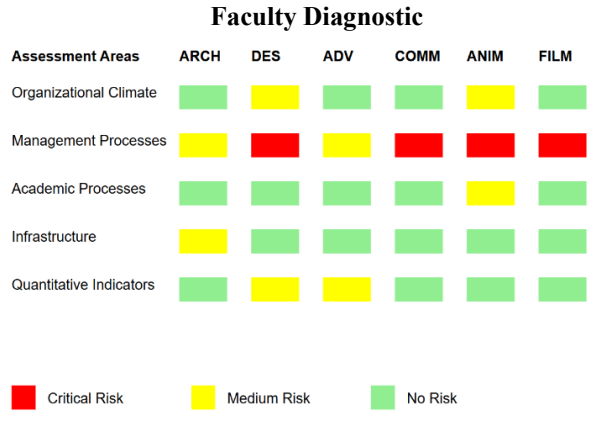

Figure 1. Diagnostic Findings
Source: Own work 2024

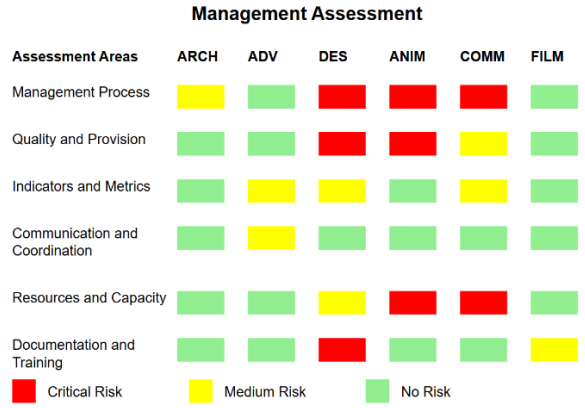

Figure 2 Management Assessment.
Source: Own work, 2024

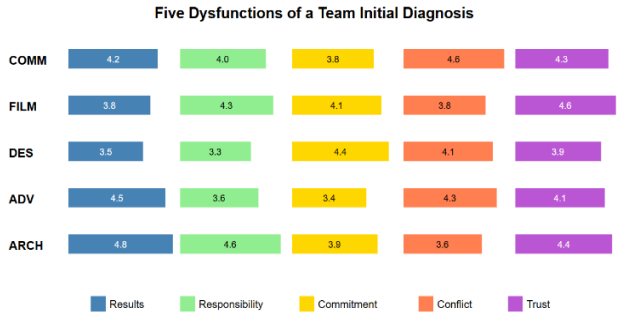

Figure 3. Five Dysfunctions of a Team Initial Diagnosis.
Source: Own work 2024.

Furthermore, by double-clicking on the general category of management processes, the efficiency of these processes is identified as a priority area of attention Fig 2. Among the measured processes, the course offering is highlighted as the most complex management process and the one that demands the most time from the directors. Therefore, it is chosen as the ideal topic for implementing a lean oriented project management within the deanery.

Moreover, with the intention of diagnosing the organizational culture and climate of the deanery this research draws upon the work of Patrick Lencioni, who since 2002 in his publication "The Five Dysfunctions of a Team," identifies the main barriers preventing teams from reaching their full potential: lack of trust, fear of conflict, lack of commitment, avoidance of accountability, and inattention to results. To identify these dysfunctions within the Creative Sciences Deanery at UPAEP, data extracted from the survey is used to assign values between 1 and 5 to the aspects of trust, conflict, commitment, accountability, and results, based on the colors of the cells (red, yellow, green). The results are as follows:

- **Trust Levels:** While some faculties exhibited high trust levels (green), others required immediate attention (red), indicating a need for targeted interventions to build and maintain trust.
- **Conflict Management:** Conflict was prevalent in

certain faculties, signaling the necessity for improved conflict resolution strategies and communication channels.

- **Commitment and Responsibility:** Variability was observed in commitment and responsibility, with some faculties demonstrating lower engagement levels, impacting overall performance.
- **Results Orientation:** Differences in results orientation were noted, with some faculties achieving their targets more consistently than others.

The initial diagnostic information regarding the five dysfunctions of a team is synthesized in Fig. 3.

3. Application and Results

The implementation of Lean thinking principles in academic administration integrates three complementary methodologies: Lean Thinking as the foundational philosophy, Andon as the visual management system, and Poka-Yoke as the error-proofing mechanism. This systematic approach focuses on three core elements: value stream mapping, waste identification, and continuous flow implementation. After identifying the target process and assessing the organizational culture, the analysis phase employed three key tools: stakeholder identification, process mapping, and activity flow, as shown in Fig. 4. These tools enabled a comprehensive understanding of organizational activities and highlighted potential areas for improvement, creating a robust framework for academic process enhancement while maintaining clear methodological connections. [13].

The result of the process diagnosis shows the following findings:

1) The stakeholders involved in the process are numerous, as shown on Fig.5. While the primary responsibility of the process lies with the faculty directors, the administrative and support areas add individuals and verification steps, slowing down the activity's progress. Moreover, with so many areas and people involved in the process, communication and decision-making become challenging [22] Although student satisfaction with scheduling is indeed a crucial consideration, students are not direct stakeholders in this specific scheduling process. While program directors take into account student requirements, course sequencing, and general student feedback in a preliminary phase, this occurs in a separate process that precedes the actual scheduling operation. The process itself is primarily determined by the university's available infrastructure and specialized classroom equipment. Student interaction resumes later during the course registration phase, which is a subsequent process to the scheduling operation being analyzed here. This separation exists because the scheduling process begins after the course offering has been determined and focuses specifically on the logistical aspects of room and time allocation.

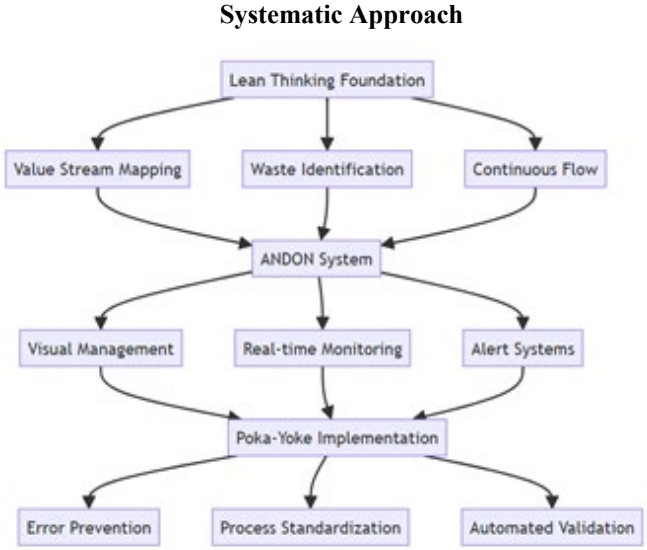

Figure 4. Systematic Approach.
Source: Own work 2024

ACADEMICS			ADMINISTRATIVES		
ACADEMIC PROGRAM	FACULTY	STAKEHOLDERS	SPACE ADMINISTRATORS	DIRECTION OF ACADEMIC SUPPORTS	LABORATORIES OF AUDIOVISUAL MEDIA AND HUMANITIES
BACHELOR'S DEGREE IN ARCHITECTURE 01 FEDERAL	ARCH			DIRECTION OF TECHNOLOGICAL PLATFORM	HEAD OF PROCESSES
BACHELOR'S DEGREE IN ARCHITECTURE 06 STATE					HEAD OF TECHNOLOGICAL ACADEMIC SUPPORTS
SPECIALTY IN CONSTRUCTION MANAGEMENT					HEAD OF INNOVATION AND DIGITAL DEVELOPMENT
MASTER'S DEGREE IN SUSTAINABLE PROJECT DEVELOPMENT				INFRAESTRUCTURE AND OPERATIONS	HEAD OF MANAGEMENT OF SPACES AND TEACHING SERVICES
MASTER'S DEGREE IN HOUSING			FINANCE	GENERAL FINANCE DIRECTOR	
BACHELOR'S DEGREE IN DESIGN AND VISUAL INNOVATION	DES			DIRECTION OF HUMAN DEVELOPMENT	LABOUR RELATIONS AND COMPENSATION
BACHELOR'S DEGREE IN GRAPHIC AND DIGITAL DESIGN				ADMINISTRATIVE DIRECTION VICE-RECTOR ACADEMIC	ADMINISTRATIVE COORDINATION DEANSHIP
BACHELOR'S DEGREE IN ANIMATION AND DIGITAL ART			COMMITTEE FOR OPTIMIZATION OF THE ACADEMIC OFFER		
MASTER'S DEGREE IN DESIGN AND INNOVATION MANAGEMENT					
BACHELOR'S DEGREE IN STRATEGY AND ADVERTISING CREATION	ADV				
BACHELOR'S DEGREE IN DESIGN AND ADVERTISING PRODUCTION					
MASTER'S DEGREE IN STRATEGIC COMMUNICATION AND INNOVATION MANAGEMENT					
BACHELOR'S DEGREE IN CINEMA AND AUDIOVISUAL PRODUCTION	FILM				
BACHELOR'S DEGREE IN COMMUNICATION AND DIGITAL MEDIA	COMM				

Figure 5. Course offering Stakeholders
Source: Own work 2024.

2) The process itself is complicated, requiring numerous steps to finalize the opening of a course. Furthermore, as can be observed in Fig. 6, the process exhibits evident bottlenecks that impede workflow and make decision-making complex due to circles of sub process repetition with unclear and unverifiable information in real-time. [23].

Figure 6. Course offering process map.
Source: Own work 2024.

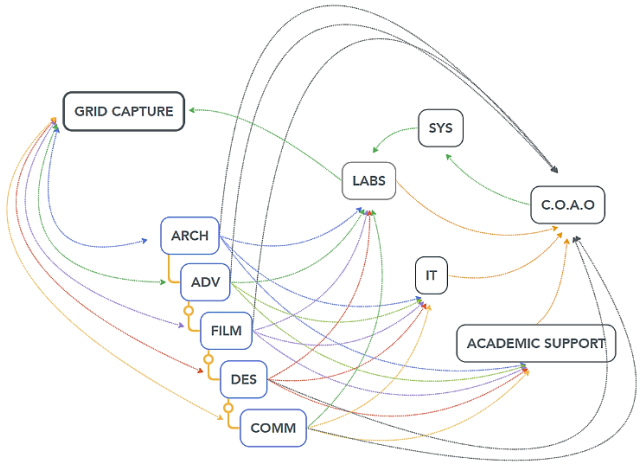

Figure 7. Course offering flow chart.
Source: Own work 2024.

3) As can be observed in Fig. 7, the flow of the process is intricate, as the main administrators of academic spaces do not share real-time information. This necessitates constant individual interactions between faculty directors and their peers, without guaranteeing the quality of information exchange [24].

3.1. Intervention

As a result of the diagnosis, an intervention model was designed based on the principles of lean project management, with the following desired objectives:

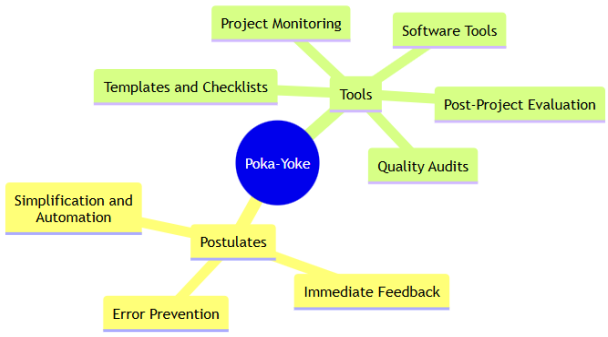

Figure 8. Intervention Design framework.
Source: Own work 2024.

- Reduced Response Times through the optimization of the chosen process that allows for agile decision-making and reduces compliance times.
- Decreased Operating Cost by eliminating waste and operational inefficiency.

The design of the intervention is based on three principles of Poka-Yoke, as expressed in Fig. 8.

3.2. Specific action

The application of the intervention consisted of conducting a workshop for the construction of the academic offering, in which all the stakeholders with an interest in the process were gathered in a physical space of the university. In it, all the academic spaces available for the teaching of courses for the deanery were placed on flipcharts and displayed on partitions throughout the place, with the description and equipment of each one of them as well as the available spaces.

Each faculty director then had the opportunity to visualize in real time the characteristics of all the classrooms and schedule the courses in the best available place, while their academic peers did the same. This allowed to avoid overlaps in the schedule of the classrooms since in case these existed, the interested parties were physically present and could negotiate with their counterpart.

On the other hand, the administrators of the classrooms and laboratories were able to take note in real time of the proposed occupation for the academic program´s offer and thus give priority to them at the time of reflecting it in to the system, which ensured that the specialized spaces are used for the courses that will make the most of them.

The workshop was held in two sessions of five hours in March 2024, to which the administrative director and the academic secretary of the deanship also joined. They were able to follow up on the economic amount required for the payment of the professors who will teach the offered courses, ensuring that while building the academic offer, the deanship's fee budget was also prepared.

After the workshop, the academic secretary held an additional one-hour meeting with each academic program director to verify that the information worked on in the workshop was reflected in the school administration system,

concluding the exercise.

- Enhanced Employee Satisfaction by directly involving them in decision-making and reducing administrative burden, which would increase team morale and reduce stress levels [25].
- To quantify the above, three main indicators were determined:
- Cycle Time Reduction in which the time dedicated to it is compared before and after the implementation of lean management actions. This will be quantified in man-hour [26].
- Cost savings, which will measure the operational cost associated with the process and its variation before and after the intervention. This item will be presented in Mexica pesos
- Employee engagement, with which the level of participation of each staff member will be identified, as well as their level of satisfaction with the improved process. This will be reflected though a satisfaction survey.

The Poka-Yoke applied to the Creative Sciences Dean's scheduling workshop is structured around several key principles:

Error Prevention: Actions include downloading all courses from current study plans with equivalencies, ensuring all subjects are considered. This is supported by templates and checklists. Standardizing and printing the weekly schedule format for each available space, in line with institutional blocks, ensures standardized information sources, complying with institutional rules through software tools. Describing the physical and technical capacities of each available space in the schedule format optimizes physical resource allocation. Color-coded trays by faculty facilitate immediate user identification.

Simplification and Automation: Actions involve standardizing criteria for naming courses, practices, and activities, thus clarifying space requirements with the aid of software tools. Visualizing the schedule for all available spaces enables optimal space selection, ensuring academic needs are met, supported by templates and checklists. Unifying information flow into a single spreadsheet, fed by the system based on the physical schedule, creates a unique information source, facilitated by software tools.

Immediate Feedback: Peer review by directors, team validation (four faculties), technical review (academic secretariat), space review (academic spaces, CETEC, computing centers), and general validation by the dean ensure information accuracy. This process, supported by project monitoring and evaluation tools, allows for real-time corrections, reducing errors in subsequent decision-making.

3.3. Results

Once the intervention Project Management was carried out, the results were documented in terms of the indicators previously described for this purpose. To determine whether the intervention meets the desired parameters, the results obtained from the same process for the 2023-2024 planning period, in which no action had been implemented, were compared with the 2024-2025 period in which the action took place. The results are synthesized in the Fig. 9.

SUMMARY TABLE OF RESULTS														
	TIME												COST	
	ACADEMIC DIRECTORS					ACADEMIC SECRETARY			DEAN					
	HRS.	DAYS	HOURS/PEOPLE	EMPLOYEES	SUBTOTAL	HRS	DAYS	SUBTOTAL	HRS.	DAYS	SUBTOTAL	INVESTED HRS	ACADEMIC PERSONAL AV. COST	TOTAL COST
BEFORE	3	17	54	5	272	3	15	45	8	1	8	325	$554.35	$180,163.75
AFTER	5	2	18	5	90	5	4	20	4	2	8	118	$554.35	$ 65,413.30

Figure 9. Application report
Source: Own work (2024)

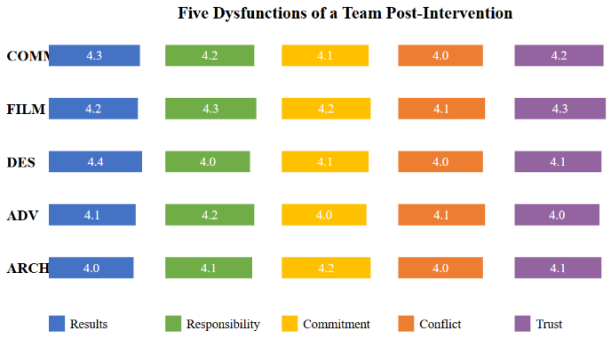

Figure 10. Five Dysfunctions of a Team Post-Intervention.
Source: Own work 2024.

After the intervention, a functional team diagnosis was conducted by an external consultant to measure its impact on the dean's office organization, based on the previously described functional team dysfunctions. The same data collection and processing methodology was used to ensure the comparability of results. The findings are summarized in the Fig. 10:

The pre-post intervention comparison of organizational climate and studied variables reveals significant improvements. Pearson correlations showed strengthened relationships between metrics such as "Results" and "Trust", suggesting that improvements in one metric are more strongly related to improvements in other metrics after the intervention. This indicates a more cohesive organizational environment and an increase in employee trust and commitment.

4. Conclusions

The results are divided into two main items that measure the time invested in the process and its cost. In the case of the former, only the academic actors involved attached to the Dean's Office of Creative Sciences, the faculty directors, the academic secretary, and the dean himself are considered.

It can be observed that in the planning period 2023-2024, without the implementation of the project, the directors dedicate an average of 54.4 hrs. to the process that is carried

out in fragmented times over 17 days. Once the intervention action is implemented, a drastic reduction in time is observed, going only to 18 hrs., this considering the two workshop sessions of five hours each, the review with the academic secretary, and allocating seven additional hours for the realization of minor adjustments. As for the academic secretary, a reduction in the time dedicated to the process is also observed, going from 45 hrs. in 2023-2024 to 20 hrs. in 2024-2025. On the other hand, the time of the Dean involved in supervision and review tasks remains the same. As secondary results derived from the exercise in terms of time, a considerable reduction was also observed in the number of days that academic authorities dedicate to the process [27], this because it was previously addressed in a disorganized manner and for a few hours a day, by concentrating the activity the time lost in resuming the thread of the activity, as well as interruptions are eliminated, making the task more efficient. On the other hand, for the economic indicator, an average parametric costing of the payroll amount of the officials involved was carried out, this average cost is multiplied by the total number of hours invested identifying an amount of $180,163.75 in 2023-2024 and $65,413.00 in 2024-2025, which represents a saving of 63.69%.

As for the third indicator, employee commitment, the satisfaction survey showed that the directors, when taken into account in the design of the workshop, felt more committed to the task. 80% of them indicated that they perceived a considerable improvement in the wear and tear that the process represents, and only one indicated that she did not observe any improvement against the previous procedure.

Upon observing the results of the indicators, which show a significant reduction in the time dedicated to the chosen process, a decrease in the economic resources allocated for this purpose, and an increased commitment from the collaborators, we can conclude that the implementation of Lean Thinking within a project management model at the Dean's Office of Creative Sciences at UPAEP (Universidad Popular Autónoma del Estado de Puebla) has yielded several benefits. These include enhanced operational efficiency, optimized resource utilization, waste reduction, and improved quality of academic services. Therefore, the hypothesis is confirmed and suggests that the adoption of Lean Thinking can be an effective strategy for improving project management in academic contexts.

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UNIVERSIDAD NACIONAL DE COLOMBIA

Design and development of a comprehensive framework to enhance leadership skills in project management

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Abstract
This research aimed to design a framework for leadership competence in project management training for industrial engineering professionals at universities in Bogotá, Colombia. Motivated by the observed absence of this competence among recent graduates. The study employed a sequential exploratory design using mixed methods. By characterizing global leadership models in project management theorized by academia and leading organizations, key variables were identified. Diagnosing the leadership competence of students generated relevant data, which were statistically analysed, facilitating academic recommendations and the framework's design. The outcome significantly contributes to the field by providing a functional and generalisable framework for universities in Bogotá, strengthening leadership competence in professional training. This research underscores the complexity and centrality of leadership in project management, highlighting the need for an adaptive and practical framework to guide the education of future professionals with holistic and applicable skills to effectively lead in volatile and ambiguous environments.

Keywords: educational standards; leadership skills; leadership structure; learning outcomes; project management.

Diseño y desarrollo de un marco integral para potenciar las habilidades de liderazgo en la gestión de proyectos

Resumen
Esta investigación tuvo como objetivo diseñar un marco de competencias de liderazgo en la formación en gestión de proyectos para profesionales de ingeniería industrial en universidades de Bogotá, Colombia. Motivada por la ausencia observada de esta competencia entre los recién graduados. El estudio empleó un diseño exploratorio secuencial utilizando métodos mixtos. Al caracterizar modelos globales de liderazgo en gestión de proyectos teorizados por la academia y organizaciones líderes, se identificaron variables clave. El diagnóstico de la competencia de liderazgo de los estudiantes generó datos relevantes, que fueron analizados estadísticamente, facilitando recomendaciones académicas y el diseño del marco. El resultado contribuye significativamente al campo al proporcionar un marco funcional y generalizable para las universidades en Bogotá, fortaleciendo la competencia de liderazgo en la formación profesional. Esta investigación subraya la complejidad y centralidad del liderazgo en la gestión de proyectos, destacando la necesidad de un marco adaptativo y práctico para guiar la educación de futuros profesionales con habilidades holísticas y aplicables para liderar eficazmente en entornos volátiles y ambiguos.

Palabras clave: estándares educativos; habilidades de liderazgo; estructura de liderazgo; resultado de aprendizaje; gerencia de proyectos.

1. Introduction

1.1 Leadership context and its importance

Leadership has been identified as an essential personal competence not only for facing the challenges of the 4.0 industrial revolution, but also for business success. In the context of this industrial revolution, leadership takes a particularly human dimension, emphasizing the need for an approach that focuses its attention on personal skills and abilities [1-3]. This vision is shared by managers of diverse organizations, who consider leadership not only as a valuable

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competence, but also as an essential element for achieving organizational objectives and the success of projects. The importance of having professionals with developed leadership skills is relevant to positively impact on business dynamics and outcomes [4]. This convergence of perspectives highlights leadership as a critical variable for innovation, Project Management (PM), and business sustainability in the era of digitalization and automation.

Contemporary organizations increasingly value the development of interpersonal skills or *power skills* [5]. This has motivated the inclusion of professionals trained in educational institutions that emphasize these competencies in their curricula. The World Economic Forum anticipated that automation and technological advances could result in the loss of 85 million jobs by 2020, underscoring the importance of a rapid adaptation to the changing labour landscape through the acquisition of these personal skills [6]. Countries like the Kingdom of Saudi Arabia and Australia have been reforming their educational systems to meet these needs, facing significant challenges, including the COVID-19 pandemic, which demand a rethinking of educational offerings to guarantee the professional future of new generations [6].

1.2 Current state of the research field

For the development of this research, an extensive literature review was conducted, where the search for academic articles and documents were essential for understanding the theme under research. The international and national analysis on leadership competence highlights the importance and the need for integrating leadership training. Countless studies have focused on the development of leadership skills among students, recognizing the relevance of these skills and abilities for professional success in the business sector.

Internationally, the following research studies in this field were identified.

- In the Autonomous Community of Aragon, Toledo, et al. [7] identified a shared perception among managers and teachers about the insufficiency of leadership training within educational institutions, highlighting the need for improving training programs to include social, communication, mediation, and conflict resolution skills. This research suggested that leadership training should be inclusive and encompass the entire educational community, including students and teachers to enhance the development of this essential competency.
- Dávila Quintana, et al. [8] focused on the impact of teaching methods and practices in higher education on leadership development, concluding that a combination of pedagogical approaches facilitates the development of leadership competencies in students which benefits their job performance. This research underscored the importance of preparing graduates to demonstrate leadership from the beginning of their professional career.
- Bruce and Stephens [9] addressed the development of specific tools to facilitate leadership learning. They proposed a toolkit for leadership learning facilitators which supports the transition of students from high school to college and from college or universities to the workplace. Yen, et al. [10] described the development of a digital toolkit, at the University of Washington, was aimed at promoting leadership among academic staff, highlighting the need for professional development opportunities focused on leadership skills.

Nationally, the following research in this field of study was identified.

- López [11] examined student leadership at the Santo Tomás University in Bucaramanga, Colombia, proposing a training program in social and political leadership. This research recognised leadership training as an important need to face current social challenges, highlighting deficiencies in communicative skills and group management as key areas for improvement.

The review of additional literature, represented in other scientific articles, complements these findings, emphasizing the relevance of leadership not only in the educational context, but also in PM and in a broader professional sphere. The inclusion of leadership training in university curricula emerges as an imperative to provide future professionals with the necessary competencies to navigate and succeed in dynamic and challenging work environments.

2. Methodology

This research was conducted as a mixed-method study with a descriptive scope because data collection was performed qualitatively and quantitatively. The integration of these methods allowed a discussion of the gathered information to gain a better understanding of leadership competency. Mixed-method research enables the expansion and enhancement of knowledge about the objects or phenomena under study through the use of numerical and textual variables, formulas, and narratives, that is, the combination of quantitative and qualitative approaches [12]. The application of the mixed method arose from the need for addressing the complexity of the problem through different realities, facilitating not only the acquisition of objective concepts, but also subjective ones [13].

The mixed method allowed adding value to this research and conducting an in-depth analysis during the study of the problem, using two methodological approaches to mitigate the uncertainty of the results. The implementation of this method, however, required considering a larger number of perspectives during the research, which enabled a more holistic and comprehensive analysis of the problem and greater certainty in the scientific conclusions [12]. The capitalization and complementarity of qualitative and quantitative approaches meant that the weaknesses and strengths of both methods were considered, contributing firstly to a greater understanding of aspects related to leadership competency associated with PM, and secondly, to an increase in the confidence of the results concerning the analysis of the problem under study [14].

The Sequential Exploratory Design (SED) was also adopted for this research. This design allowed the analysis of quantitative data collected, to be developed based on qualitative information that was identified, thus connecting

both types of data and enabling an integration of both approaches [12]. This comparison was followed by the presentation of a leadership framework for PM based on quantitative and qualitative results, allowing a deepening of the results in favour of the research product [15]. Similarly, within this design, the derivative modality according to its characteristics was the foundation for the research development. The SED enabled the research to be conducted based on constructivist principles.

The SED was chosen because it possesses the necessary elements to develop instruments which facilitated the collection of relevant information, such as a diagnostic questionnaire [16]. This design generally comprised three phases to investigate a theme in depth. In the first phase, to characterize leadership models applicable to PM through a literature review, allowing the identification of variables to be developed in this research. In the second phase, the qualitative results enabled the design of an instrument to diagnose the leadership competency associated with PM and to administer the instrument to two groups, whose collected data was analysed statistically.

Finally, a shift was made to a post-positivism principle to identify and measure quantitative variables. The quantitative data was identified and interpreted in ways that generalized and expanded the qualitative results and could be employed in the proposal for designing a leadership framework for PM.

3. Results

The initial result of this research was the generation of a co-occurrence matrix using the T-Lab software, which identified eleven (11) clusters (see Fig. 1), which were lemmatized in relation to the group of words forming them (see Table 1). This matrix was generated thanks to the development of a qualitative approach, where a detailed review of the literature was conducted. The verification of eight of the main organizations (Project Management Institute® - PMI®; Centre of Excellence in PM² - PM², International Project Management Association – IPMA; Association for Project Management – APM; Projects in Controlled Environments - PRINCE2; Guidance on Project Management - ISO 21500; Australian Institute of Project Management – AIPM; and Project Management Association of Japan – PMAJ) focused on the study of PM at a global level was performed [16-19], allowing the analysis of specific information regarding leadership from guide books or texts on PM from these organizations to be the main inputs for the generation of the clusters. This verification ensured that the mentioned organizations encompassed knowledge developed in projects across different continents, such as: America, Asia, Europe, and Oceania.

The results of the qualitative analysis, which identified eleven (11) clusters, served as the basis for designing a questionnaire aimed at diagnosing leadership in PM among final-semester students from universities in Bogotá, Colombia and Colombian business professionals. To ensure the overall relevance and precision of the statements, the questionnaire design was based on the Leadership Competency Development Framework, established in the Project Management Competency Development Framework (PMCD) of the PMI®, adjusted to the needs of both groups.

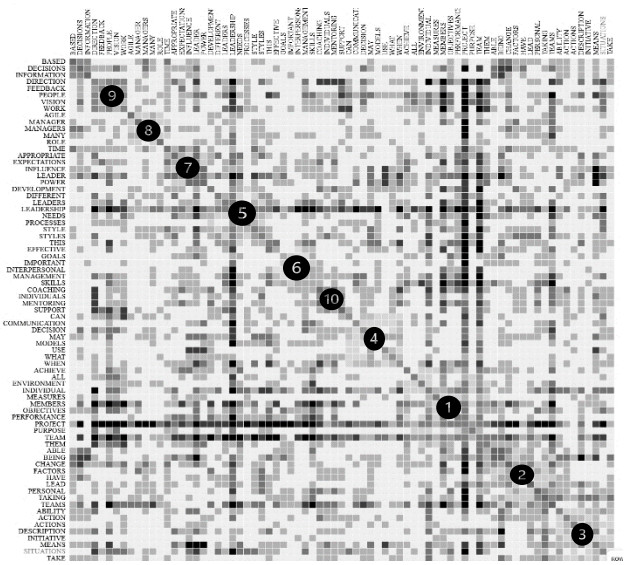

Figure 1. Concurrence matrix.
Source: Own elaboration by using T-Lab software.

Table 1.
Clusters.

Cluster	Themes
1	Development and management of teams in projects.
2	Leadership in the context of changes and adaptability in team management.
3	Proactive competence and adaptability in changing situations through the use of skills and resources.
4	Interaction of communication and decision-making based on established frameworks or reference structures.
5	Development and adaptability in leadership style based on changing needs.
6	Integration of management and interpersonal skills to achieve objectives effectively.
7	Role of influence and power in leadership and managing expectation in PM.
8	Role of the manager in an agile context and their temporal and functional relationship in PM.
9	Process of guiding a team toward a vision through interaction and feedback in PM.
10	The role of guidance and support in the development of individuals within PM.
11	Decision-making based on information.

Source: Own elaboration.

The questionnaires were structured with three statements per cluster (these statements were also referred to as the cluster variables within this study), formulated to be answered using the Likert scale [20]. The questions, although adapted in wording for students and business professionals, maintained a coherence which allowed the comparison of the mean of the independent populations. Additionally, control questions were strategically placed and added to assess the seriousness and consistency of the answers. This approach not only enabled the creation of a solid instrument to measure leadership competence, but also facilitated a meaningful and detailed diagnosis for both groups.

The validation process of the instrument was conducted in two phases. First, a pilot test was administered to eighth-semester industrial engineering students and business

professionals which allowed verification of the clarity and relevance of the questions and received direct feedback on the comprehensibility of the questionnaire. Second, the validation was performed by academics and expert business professionals with high academic qualifications, who made recommendations to adjust the instrument, ensuring that it reflected leadership skills in the Colombian business context. In both cases, the *omega coefficient* (see Fig. 2) was applied as a method to estimate the reliability of the instrument [21].

For the students, the omega coefficient yielded a value of 0.99, indicating excellent reliability. Similarly, the omega coefficient applied to the instrument for the business professionals confirmed a high reliability, with a value of 0.97.

This process enabled the creation of a robust and reliable questionnaire with a solid theoretical foundation, which was administered to fifty (50) students and twenty-two (22) business professionals. The comparison between both populations offered valuable insights into the differences and similarities in the perception of leadership in PM within the field of industrial engineering. The high reliability of the instruments, demonstrated by the omega coefficient values, supported the quality of the results obtained in both groups.

The diagnosis applied to the two (02) independent populations —final-semester students and Colombian business professionals— was subjected to a rigorous statistical analysis using SPSS software. This enabled to compare the responses between both groups and evaluate the difference in perception regarding leadership competence in PM, the Mann-Whitney test was employed [22]. This test is widely recognized in non-parametric statistics for its ability to compare two independent samples, especially when variables are measured on ordinal scales, as is the case with the responses obtained through Likert scale-based surveys.

The analysis using the Mann-Whitney test enabled the examination of each of the eleven clusters separately. In most cases, the resulting *p-value* was less than 0.05, leading to the rejection of the null hypothesis [22, 23]. This means that, in general, there were significant differences between the perceptions of students and business professionals regarding leadership competencies. The results indicated that both groups had different experiences and expectations concerning how leadership skills were developed and applied in PM.

An interesting aspect of the analysis was that, in some clusters, specifically cluster 6 (Integration of management and interpersonal skills to achieve objectives effectively) and cluster 8 (Role of the manager in an agile context and their temporal and functional relationship in PM.), certain variables presented a *p-value > 0.05*. In these cases, the null hypothesis was not rejected, indicating that there were not significant differences between the responses of students and business professionals. This suggested that both groups shared a similar view on specific aspects of leadership, such as the integration of technical and social skills in the work environment, and the ability to assume relevant roles in agile work contexts. These findings indicated that universities have been playing an important role in the development of these key leadership skills, and the employers value these abilities positively in recent graduates.

$$\omega = \frac{\left[\sum_{i=1}^{i} \lambda\right]^2}{\left[\sum_{i=1}^{i} \lambda\right]^2 + \left[\sum_{i=1}^{i} 1 - \lambda_i^2\right]}$$

Figure 2. omega coefficient.
Source: Ventura-León and T. Caycho-Rodríguez, 2017.

Following the Mann-Whitney analysis, an exploratory factor analysis was conducted to validate and simplify the previously generated clusters. The main objective of this analysis was to identify underlying relationships among the variables that would allow them to be grouped into factors, thereby reducing the complexity of the initial clusters and facilitating a clearer interpretation of leadership competency in the field of industrial engineering. To ensure the suitability of the data for this type of analysis, two fundamental tests were applied: the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity.

The KMO test evaluates whether the correlations among the variables are strong enough to justify reducing them to a smaller number of factors [24]. The results of the analysis yielded KMO values ranging between 0.65 and 0.90, indicating that the correlations were adequate for conducting factor analysis. A KMO value close to 1.0 suggests that the variables are highly correlated, while values below 0.5 would indicate the correlations are not strong enough to proceed with the analysis. In this case, the obtained values reinforced the validity of the analysis and the suitability of the selected variables to be grouped into factors.

On the other hand, Bartlett's test of sphericity is used to determine if there is a significant correlation among the variables which constitute the data matrix [24]. The result of this test was evaluated through the *p-value*, where a value less than 0.05 indicated that the correlations among the variables were significant and it enabled to proceed with the factor analysis. In this study, the obtained *p-values* were consistently less than 0.05, which statistically validated the use of factor analysis. This test was crucial to ensure that the variables were not independent of each other, justifying their grouping into factors.

Using these results, the exploratory factor analysis allowed the grouping of the eleven (11) clusters into four (04) main factors, which represent different dimensions of leadership in PM. Each of these factors was identified based on the correlations found among the variables and the nature of leadership competency, as presented in Table 2.

The grouping of the clusters into these four factors provided a clearer and more structured view of the leadership competencies in industrial engineering which is necessary to effectively manage projects. The statistical validation of these

Table 2.
Clusters comprising the factors.

Factor	Clusters grouped by the factor	Denomination of the factor
1	C1 y C2	Adaptive Team Management
2	C3, C4 y C5	Strategic Adaptability and Effective Communication
3	C6 y C7	Management of Influence and Integrated Skills
4	C8, C9, C10, C11	Agility in Leadership and Support

Source: Own elaboration.

factors, supported by the KMO measure and Bartlett's test of sphericity, ensured that the selected variables were adequately correlated, and the generated factors were reliable representations of the dimensions of leadership. This process facilitated the understanding and the use of the obtained results, enabling a more efficient evaluation and a more coherent interpretation of leadership skills in PM, both for industrial engineering students and for business professionals.

Once the four factors and their respective variables were identified, which ranged from six (06) to eleven (11) variables per factor, an effort was made to simplify the Framework under investigation by verifying the weighting of the factors' variables. This verification was conducted using multiple linear regression models through SPSS software [24]. The statistical analysis allowed the identification of the two (02) most statistically significant variables within each factor which became the main inputs for constructing a comprehensive framework to enhance leadership skills in PM.

For each of the four (04) factors, multiple linear regression analysis allowed to determine the relative importance of the variables. This methodology enabled the identification of which variables within the factors required greater emphasis in the education of students in university industrial engineering programs in Bogotá, aligning with the needs of the business sector. The results also showed a clear correspondence between the expectations of both students and business professionals regarding leadership competencies.

Factor 1: Adaptive team management

This factor groups variables related to adaptability and leadership in constantly changing environments. The statistical analysis indicated that the most relevant variables were: V_5 *Guiding teams through unexpected changes and challenges* and V_6 *Capability to reinvent oneself based on shifts in the work environment to guide a team towards success*.

The multiple linear regression analysis yielded a correlation coefficient of 88.1% for the first model, which means that variable 5 explains this percentage of the factor. By adding variable 6 to the model, the coefficient increased to 94.7%, indicating that these two variables together explain a significant portion of adaptive team management. The other four (04) variables of the factor contributed a minimal percentage to the model; therefore, they were not elaborated upon further for the purposes of this study.

Factor 2: Strategic Adaptability and Effective communication

This factor addresses competencies related to making informed decisions and the ability to anticipate and adapt to changing situations. The key variables were: V_{13} *Making informed decisions based on clear frameworks of reference* and V_8 *Anticipation of obstacles and proactive response in changing work situations*.

In this case, the correlation coefficient for the first model was 85.4%, indicating that variable 13 had a high explanatory weight in the factor. By incorporating variable 8, the correlation coefficient increased to 92.3%. The other seven (07) variables of the factor showed a minimal contribution to the model.

Factor 3: Management of Influence and Integrated Skills

This factor is related to the ability to influence teams and manage expectations in a balanced manner. The variables identified as most relevant were: V_{23} *Managing team members' expectations and conducting negotiations to influence individuals* and V_{17} *Balancing administrative tasks and interpersonal relationships to ensure the achievement of goals within an organization*.

The correlation coefficient for the first model was 84.1%, indicating that the variable 23 had a high explanatory weight in the factor. For the second model, which included the variable 17, a coefficient of 91.7% was obtained. This result underscored the importance of these two variables for this factor.

Factor 4: Agility in Leadership and Support

This last factor focused on the ability of leaders to guide their teams in agile environments and provide effective support. The two most important variables were: V_{33} *Supporting and promoting decision-making in work teams, based on concrete data and information* and V_{27} *Capability to establish and articulate a clear vision to a work team within a workplace context.*

The correlation coefficient for the first model was 85.5%, increasing to 93% when including the variable 27 in the second model. The other eleven (11) variables of the factor contributed minimally to the model.

Table 3.
Variables comprising the factors.

Factors	Variables comprising the factor	Variables' names
1. Adaptive Team Management	Variable $_5$	Guiding teams through unexpected changes and challenges.
	Variable $_6$	Capability to reinvent oneself based on shifts in the work environment to guide a team towards success.
1. Strategic Adaptability and Effective Communication	Variable $_{13}$	Making informed decisions based on clear frameworks of reference.
	Variable $_8$	Anticipation of obstacles and proactive response in changing work situations.
2. Management of Influence and Integrated Skills	Variable $_{23}$	Managing team members' expectations and conducting negotiations to influence individuals.
	Variable $_{17}$	Balancing administrative tasks and interpersonal relationships to ensure the achievement of goals within an organization.
3. Agility in Leadership and Support	Variable $_{33}$	Supporting and promoting decision-making in work teams, based on concrete data and information.
	Variable $_{27}$	Capability to establish and articulate a clear vision to a work team within a workplace context.

Source: Own elaboration by using multiple linear regression models, which allowed the identification of the most significant variables within each factor

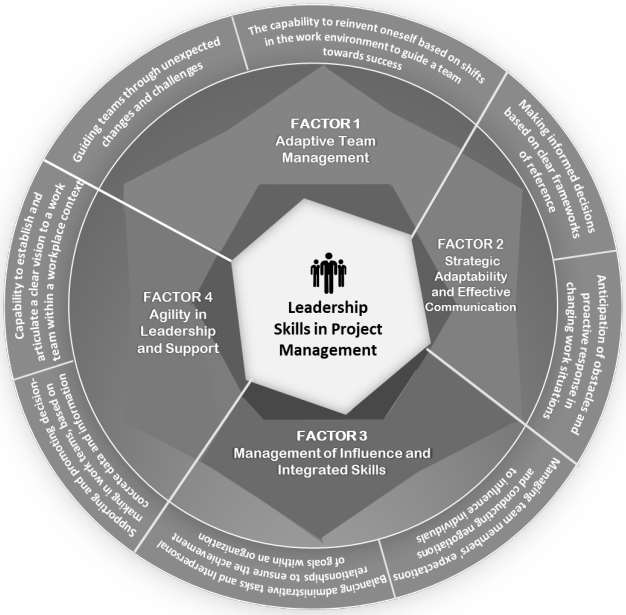

Figure 3. Comprehensive framework to enhance leadership skills in project management.
Source: Own elaboration

In summary, the statistical analysis enabled the simplification of the initially identified factors by highlighting the two most relevant variables of each factor. These variables provided a solid foundation for creating innovative tools which support the strengthening of leadership among students in industrial engineering programs in Bogotá D.C., Colombia, while also aligning with the expectations of the business sector. The key variables of each factor are summarized in Table 3.

The result of the qualitative and quantitative analysis was the creation of a Comprehensive Framework for Strengthening Leadership Skills in Project Management (see Fig. 3). This framework offers a holistic view of the key skills which constitute leadership in project management, providing an integrated approach to understanding and developing this competency. The framework highlights four (04) main factors, each composed of two (02) variables identified as critical for effective leadership performance in the context of project management.

4. Conclusions

This research, conducted through the co-occurrence analysis of words with tools like T-LAB, demonstrated a close relationship between leadership and PM, highlighting the complexity of leadership. The identification of key terms such as leadership, teams, and communication revealed that leadership competency goes beyond merely supervising tasks to encompass comprehensive management involving team development, adaptability, and informed decision-making, pointing towards effectiveness and support which promote agility. The structuring of thematic clusters offered a clear perspective on how these terms intertwine within the project context, providing a replicable framework to enhance relevant leadership skills in PM.

Additionally, the research underscored a critical challenge in the educational field of industrial engineering programs, where, despite the commitment to foster leadership among students, there is a demonstrated need for a well-defined framework which encompasses leadership in PM for the field of industrial engineering knowledge, guiding the methodology of professional teaching. The diversity in teaching methods, far from being seen as a hindrance, presents multiple opportunities for innovation. However, this also highlights the importance of adopting a more adaptive and practical approaches based on scientific research, to adequately prepare future professionals for the demands of the business environment.

This research proposes a comprehensive framework to enhance leadership skills in project management as the result of a sequential qualitative and quantitative analysis aiming not only to theoretically strengthen leadership in the professional training of industrial engineers in relation to PM, but also to promote its practical application in real work contexts. Training industrial engineering leaders capable of guiding teams towards success in increasingly volatile and ambiguous global project-based markets was a priority during the development of this research and the research product could undoubtedly have a positive impact on orienting such training in a more functional way.

Finally, this document is the result of the master's research work in project management, titled: Toolkit for Strengthening Leadership Competency Associated with Project Management in Professional Training. This research was developed in collaboration with the research group: Production and Innovation and Technology of the Faculty of Engineering at Universidad Militar Nueva Granada.

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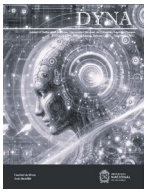

UNIVERSIDAD NACIONAL DE COLOMBIA

Optimizing Project: workplace well-being, quality of working life and organizational climate in public entities of Bogotá

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Abstract
The Administrative Department of District Civil Service (DASCD) in Bogotá manages human resources across 52 public entities. Since 2022, it has independently measured workplace well-being, work quality of working life, and organizational climate. This research aimed to develop a preliminary theoretical model explaining the relationships between work well-being, quality of work life, and organizational climate, in order to facilitate the design of policies and practices that improve the efficiency and agility of projects and human resources management within public entities in Bogotá. The research employs a mixed-methods approach. The qualitative aspect includes a review of the literature and open and axial coding, while the quantitative aspect involves a descriptive correlational analysis. The validation exercise demonstrated a strong positive correlation between the constructs of the research: well-being and quality of life (r=0.92), well-being and organizational climate (r=0.93), and organizational climate and quality of life (r=0.94). These findings confirm the relationships established in the theoretical framework.

Keywords: Project management; well-being; quality of work life; organizational climate; human resources management

Optimizando Proyectos: bienestar, calidad de vida laboral y clima organizacional en entidades públicas de Bogotá

Resumen
El Departamento Administrativo del Servicio Civil Distrital (DASCD) en Bogotá gestiona los recursos humanos de 52 entidades públicas. Desde 2022, realiza mediciones de Bienestar, calidad de vida laboral y clima organizacional de forma independiente. Esta investigación tuvo como objetivo construir un modelo teórico preliminar explicativo de las relaciones entre el bienestar laboral, la calidad de vida laboral y el clima organizacional, con el fin de facilitar el diseño de políticas y prácticas que mejoren la eficiencia y agilidad de los proyectos y la gestión de recursos humanos dentro de las entidades públicas de Bogotá. La investigación emplea un enfoque de método mixto. Lo cualitativo abarca una revisión de la literatura y codificación abierta y axial, mientras que lo cuantitativo implica un análisis correlacional descriptivo. El ejercicio de validación demostró una fuerte correlación positiva entre los constructos de la investigación: bienestar y calidad de vida (r=0,92), bienestar y clima organizacional (r=0,93), y clima organizacional y calidad de vida (r =0,94). Estos hallazgos confirman las relaciones establecidas en el marco teórico.

Palabras clave: gestión de proyectos; bienestar; calidad de vida laboral; clima organizacional, gestión de recursos humanos.

1 Introduction

In recent decades, the social environment has undergone significant transformations, and project management within public entities faces challenges that necessitate innovative approaches to ensure efficiency and agility in project execution [1]. Within this context, the relationship between quality of life, organizational climate, and Well-being has

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emerged as a crucial area of research [2]. These factors directly influence job satisfaction and, ultimately, organizational performance [3].

1.1. Quality of work life (QWL)

Quality of work life (QWL) is a subjective concept that encompasses both formal and informal aspects of work [4], affecting the psychological development of individuals within their social environment [5]. This concept is related to the adaptability, creativity [6], and determination required to meet the organization's productive objectives [7]. Organizations that foster high levels of QWL positively influence employee satisfaction [8], enhancing their physical, psychological, and emotional health [9]. Additionally, companies that provide autonomy and creative workspaces [10], equipped with the resources necessary to meet job resources-demand and that strive for a balance between the organization, the job, and the employees [11], achieve greater economic benefits and social recognition [12-14]. Promoting improvements in QWL translates into the humanization of work [15].

1.2. Well-being

Well-being encompasses multiple dimensions [16], including the physical, emotional, and social well-being of employees [17] within their work social environment [18]. This construct is essential for the overall health of employees and their ability to perform effectively [19]. Currently, constant imbalances between Job Resources-Demand, conditions, and personal needs result in high levels of stress [20,16] and mental health problems [21,22], which significantly affect well-being and QWL [23], consequently impacting organizational outcomes [24]. This demonstrates that Well-being is closely related to organizational commitment [25] and productivity [26]. In response, organizations can focus on reducing sources of stress [27] and developing individual and collective skills and techniques to manage conflict effectively [28]. In practice, this can be achieved through personal and professional development programs [19,29].

1.3. Organizational climate

In this regard, organizational climate and Well-being are fundamental constructs that determine employees' perceptions of their work social environment [30] and their satisfaction with work life [31]. The literature consistently demonstrates that a positive organizational climate and a high level of Well-being are associated with improved job performance [32,33], lower employee turnover [21] [34] due to increased motivation and sense of belonging, and greater efficiency in project management [3,4]. Optimizing these factors becomes a strategic priority in organizations where bureaucracy and formal procedures can create a challenging social environment [35].

These findings highlight the necessity of developing skills for creating healthy, positive, and productive social environments in any diverse professional setting [36]. Projects undertaken by public and private enterprises inherently require high degrees of adaptation, change management, flexibility, and agility [37].

For example, leadership, commitment, and empathetic, collaborative communication are essential for maintaining a positive and motivating social environment, which in turn influences Well-being and the emotional satisfaction of project teams [36]. Assertive and empathetic communication enables constructive conflict resolution, promoting a harmonious organizational climate and enhancing the sense of belonging and commitment to the project and the organization [38]. Additionally, competencies such as adaptability and time management help teams to address challenges efficiently, improving quality of work life and reducing stress [37].

In conclusion, work-life quality (QWL), workplace well-being, and organizational climate are closely related concepts, where QWL acts as an integrative hub for the objective conditions of work and the individual perceptions that determine employee satisfaction. Proper QWL involves not just improving physical environments but also including psychosocial dimensions like safety, personal development, and fairness. When these conditions align with employees' expectations and needs, it fosters workplace well-being, which positively impacts performance and organizational. Workers who feel their organization cares about their well-being and provides a safe and motivating environment usually experience a positive organizational climate, boosting cohesion, reducing absenteeism, and strengthening the sense of belonging [39]

In this sense, the organizational climate serves as a key indicator of QWL and workplace well-being, reflecting workers' perspectives on the quality of their work environment. According to Fernández Ríos (1999) [40], a favorable organizational climate is a direct result of high QWL, where the balance between business objectives and worker needs is essential. A positive climate enhances emotional well-being and reduces work stress, thus favoring the psychological health of workers and their performance.

2. Methodology

This research aims to develop a preliminary theoretical model of relationships between the constructs of workplace well-being, quality of working life, and organizational climate, adopting a mixed-method approach. The qualitative approach addressed literature review methods and open and axial coding, while the quantitative approach conducted a descriptive correlational analysis. The preliminary theoretical model used the qualitative approach, and the model validation used the quantitative approach. The unit of analysis consists of three district public entities coordinated by the District Administrative Department of Civil Service (DASCD) in the city of Bogotá.

The methodological sequence consisted of four stages: an initial literature review, followed by an open and axial coding

exercise to identify variables related to workplace well-being, quality of working life, and organizational climate. Based on identifying these variables, the preliminary model proposal was developed, concluding with a statistical validation stage of the preliminary model.

The literature review utilized Scopus and Google Scholar databases as sources of information. The search equations used were "Organizational climate", "Workplace well-being " and "quality of working life," which yielded 745,000 related articles. Time selection criteria were applied: 2019-2023; type of article: review, identifying 245 articles, which were reviewed by title and abstract, to finally identify 40 articles used in the analysis and coding stage.

From the 40 articles, an exercise of in-depth reading and categorization was carried out. In the first stage of inductive open coding, the concepts, properties, and dimensions of the research constructs of workplace well-being, quality of working life, and organizational climate were identified, and through axial coding, the variables of the constructs were compared, regrouped, and interpreted.

Next, the relationships between the constructs and their variables were analyzed based on a theoretical reflection. The process converges in developing the preliminary theoretical model, where the number of times each relationship is confirmed in the literature is established for each relationship.

Finally, quantitative correlational analysis is employed to empirically validate the preliminary model by applying measurement instruments of the constructs to three entities within the District. Bivariate correlations were conducted using Pearson's r coefficient to evaluate the degree of association between the research constructs and their associated variables. A significance level of $p < .05$ was employed in the statistical analyses, conducted using SPSS version 29.0.2.0. The findings will facilitate refinements to the preliminary model.

3.Results

3.1. Open and Axial coding

Open coding was conducted deductively, identifying two key criteria in the review of the articles. The first criterion sought to find the variables associated with each construct of the research: workplace well-being, quality of working life, and organizational climate. By the end of the exercise, 14, 16, and 13 associated variables were identified, respectively. The second criterion aimed to identify the number of times authors confirmed a relationship between variables and constructs, yielding an average of 156 identified and confirmed relationships by the authors to preliminarily identify the relevance and strength of the relationships between dimensions and constructs. Table 1 shows the results.

Through an axial coding exercise, the variables identified in the open coding stage were restructured and confirmed under each research construct. The grouping was determined based on the concepts and properties of each variable from the theory.

Table 1.
Identified Variables in the Open Coding Stage

No	Variables	Constructs		
		Workplace well-being	Quality of working life	Organizational Climate
1	Job development	27	32	6
2	Working conditions	3	37	19
3	Job satisfaction	16	28	7
4	Organizational culture	5	10	27
5	Motivation	10	13	12
6	Mental health	15	8	5
7	Physical work environment	12	16	
8	Social interaction	6	9	8
9	Workers' happiness	16	4	1
10	Self-development	8	12	
11	SST	8	10	
12	Organizational performance	1		13
13	Individual perception			12
14	Organizational structure	2	3	5
15	Autonomy		5	
16	Leadership	1		4
17	Conflict-tolerant		1	2
18	Physical health		3	
19	Social support		2	
	Total	130	222	119

Source: Own elaboration. The data indicate the number of relationships confirmed by the authors, between the variables and constructs of the research.

For example, under the variable "Contractual Conditions" associated with the construct working well-being, those concepts and characteristics that denote working conditions were grouped: salary, job security, job stability, humanization of work, economic stability, worker protection, work hours. Finally, 9 variables associated with well-being, 6 for quality of work life, and 6 for organizational climate were identified.

A significant outcome to highlight from the axial coding exercise is the recognition of job satisfaction as an outcome variable, which cognitively measures workplace well-being and quality of working life, and in turn, directly impacts the organizational climate. This means that job satisfaction is a reference variable for measuring the presence of the research constructs within the entity under study. Table 2 shows the results of the axial coding.

Table 2.
Identified Variables in the Axial Coding Stage

Construct		Variables
Workplace well-being	9	Social Support, Contractual Conditions, Development, Personal Development, Social Environment, Leadership, Mental Health, SST, Decision-Making
Quality of Working Life	6	Autonomy, Work-Life Balance, Motivation, Job Resources-Demand, Interpersonal Relationships
Organizational Climate	6	Social Support, Communication, Administrative Management, Conflict Management Motivation, Sense of Belonging
Job satisfaction	1	Result variable

Source: Own elaboration. Data presented in this table were compiled by the author.

Based on the open and axial categorizations and the number of citations of each relationship, the preliminary model of relationships between the constructs of workplace well-being, quality of working life, and organizational climate was built.

The construction of the model began by describing the fundamental relationships of the constructs: See Fig. 1 and Fig. 2.

The relationship between organizational climate and the constructs of workplace well-being and quality working of life is determined by the employee's level of satisfaction; If workplace well-being is reached, quality of work life is achieved, increasing employee satisfaction and this situation, in turn, allows for a positive organizational climate.

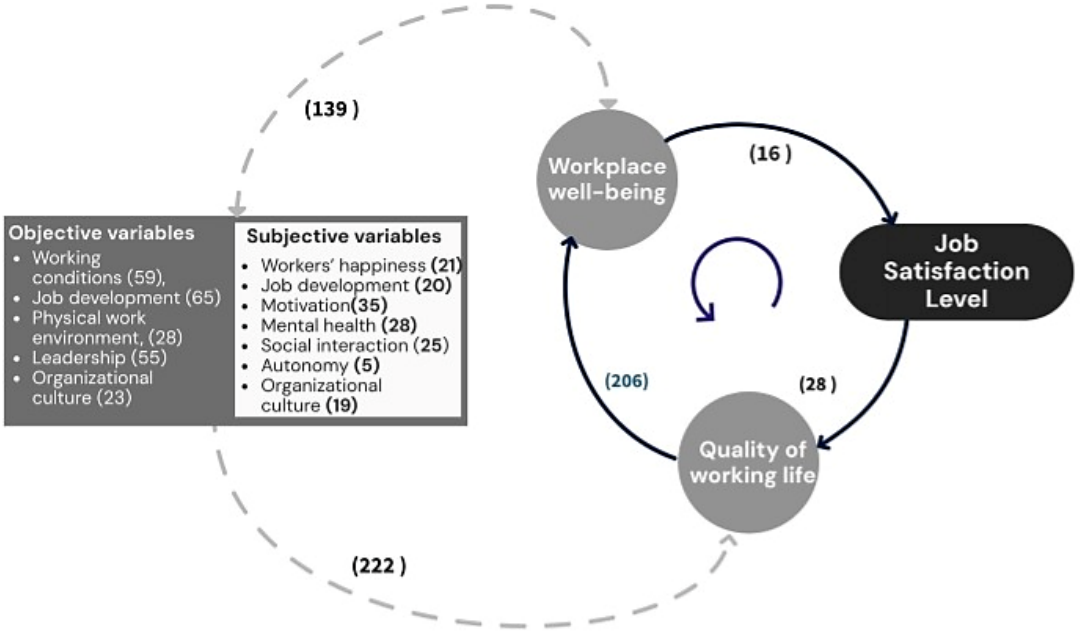

Figure 1 Workplace well-being and quality of working life relationship.
Source: Own elaboration. (#) shows the frequency with which the relationship is confirmed according to the authors

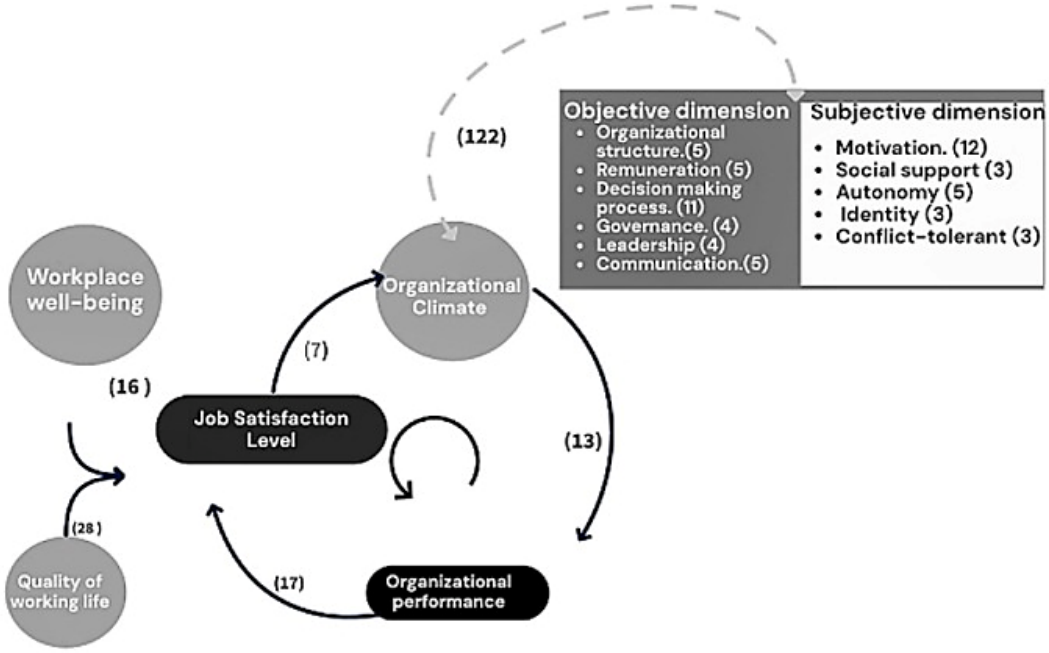

Figure 2 Workplace well-being, quality of working life and organizational climate relationship
Source: Own elaboration.

3.2. Preliminary model validation

The preliminary model was validated through a statistical correlation exercise. The population of the present study comprised approximately 2029 employees from three public entities in Bogotá. For data collection, questionnaires were distributed among employees working under contractual arrangements. See Table 3.

A comprehensive evaluation instrument was distributed within each organization to gauge perceptions regarding the variables linked to the research constructs. This instrument comprised 64 questions employing a 4-point Likert scale: Strongly Disagree (SD=3), Disagree (D=2), Agree (A=1), and Strongly Agree (SA=0). A score of 0, denoting a positive perception of the evaluated variable, was the desired outcome. The 64 questions were distributed as follows: 23

questions for Working Well-being, 15 questions for Quality of Working Life, 16 questions for Organizational Climate, and 6 questions for Satisfaction Level. The Likert scale results were utilized to compute the maximum evaluation percentage for each variable. For instance, if the evaluation of autonomy was 7 out of a maximum value of 15 (corresponding to 5 questions), the percentage was calculated as ((7/15) * 100), resulting in 46.66%. These standardized values were subsequently employed for the correlation analysis. A scatter plot was employed in this study to validate whether the linearity assumption was satisfied. The findings substantiated that the linearity assumption was indeed met.

The correlation analysis sought to ascertain both the magnitude and direction of the relationships between the research constructs, thereby validating the preliminary relational model. The findings are displayed in the accompanying Table 4.

Table 3.
Description of the population and sample used in the correlation analysis

Entitie	Population	Sample	% Sample
Entitie 1	103	70	68%
Entitie 2	4342	1440	33%
Entitie 3	861	513	60%

Source: Own elaboration. Data were collected from the (DASCD) of Bogotá and compiled by the author.

Table 4.
Pearson correlation analysis results

Constructs	Pearson Correlation Coefficient (r)	High and positive relationship	Moderate and positive relationship	Low and positive relationship
Worplace Well-being - Satisfaction Level	r= 0,846 p = 0.01	Social Support (r= 0,81)	Leadership (r= 0,77)	Contractual Conditions (r= 0,61)
		Development (= 0,81)	Mental Health (r= 0,75)	Personal Development (r= 0,59)
		SST (r= 0,83)	Decision-Making (r= 0,65)	Social Environment (r= 0,50)
Quality of Working Life- Satisfaction Level	r= 0,86 p = 0.01	Interpersonal Relationships (r= 0,85)	Job Resources-Demand (r= 0,75)	Autonomy (r= 0,67)
			Motivation (r= 0,74)	Work-Life Balance (r= 0,61)
Organizational Climate Life-Satisfaction Level	r= 0,88 p = 0.01	Social Support (r= 0,81)	Conflict Management (r= 0,76)	Management (r= 0,59)
			Sense of Belonging (r= 0,72)	Communication (r= 0,67)
			Motivation (r= 0,74	

Source: Own elaboration: Data presented in this table were collected from SPSS version 29.0.2.0 by the author

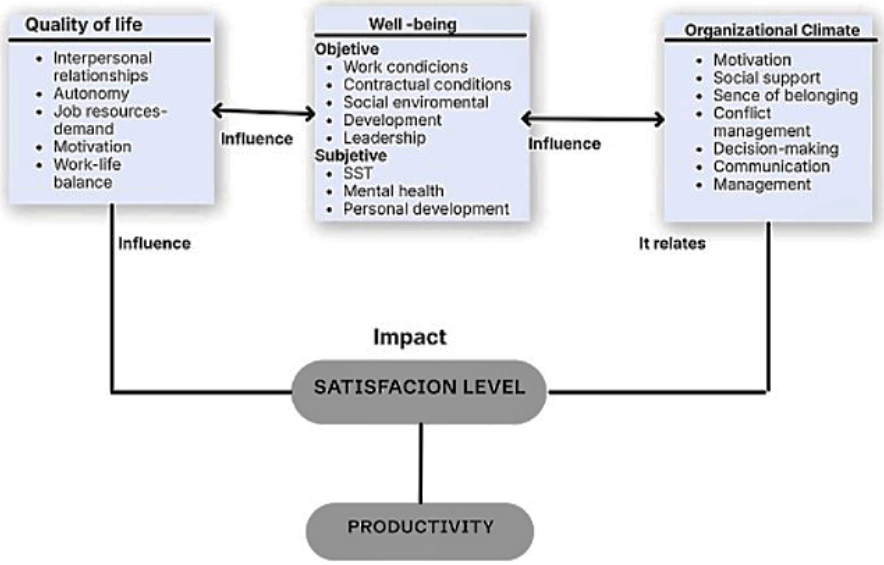

Figure 3. Final model
Source: Own elaboration

The theoretical model proposes several interrelationships between the constructs:

Quality of Working Life and Workplace Well-being: The quality of work life significantly influences employees' well-being in both objective and subjective dimensions. For instance, high autonomy and a good work-life balance can enhance both working conditions and employees' mental health

Workplace Well-being and Organizational Climate: Employees' well-being, influenced by working conditions and social support, is closely related to the organizational climate. A work environment that promotes health and safety, effective conflict management, and efficient communication can significantly improve employees' subjective well-being

Organizational Climate and Productivity: A positive organizational climate directly impacts productivity. Factors such as motivation, a sense of belonging, and effective administrative management facilitate an efficient and collaborative work environment, resulting in higher levels of satisfaction and productivity.

Satisfaction and Productivity: Job satisfaction acts as a mediator between organizational climate and productivity. Employees who are satisfied with their work environment and conditions are more likely to be productive and contribute positively to organizational goals

4. Conclusions

The theoretical construction of the model enabled the identification of the multidimensional nature of each research construct—workplace well-being, quality of working life, and organizational climate—as well as a strong positive relationship between them. However, the multidimensional nature of each construct complicates the precise definition of each dimension, as they are interpreted and associated with each construct differently depending on the perspectives of various authors. This research undertook a rigorous exercise in understanding, coding, and synthesizing dimensions to develop an easily implementable model in organizations.

The process of theoretical coding and validation identified 9, 15, and 16 key dimensions for workplace well-being, quality of work life, and organizational climate, respectively. Furthermore, a strong positive relationship was theoretically established between the constructs and their dimensions. The preliminary model was constructed based on the number of confirmatory citations of construct relationships and their dimensions found in the reviewed articles. In total, 250 citations of relationships between the three constructs were identified.

The validation exercise using correlation analysis demonstrated a strong positive correlation between the research constructs: well-being and quality of life (r=0.92), well-being and organizational climate (r=0.93), and organizational climate and quality of life (r=0.94). These findings confirm the relationships established in the theoretical framework.

In the theoretical exercise, the variable "Job satisfaction " was identified as a measure of workplace well-being and quality of working life, as well as an influential factor in the organizational climate. The validation exercise confirms this assertion: well-being and Job satisfaction (r=0.846), quality of life and Job satisfaction (r=0.86), and Job satisfaction and organizational climate (r=0.88).

The correlation results among the dimensions of each construct reveal four dimensions with a strong and positive relationship (r greater than 0.80): social support, job development, occupational health and safety (SST), and interpersonal relationships. Additionally, dimensions with a moderately high correlation coefficient (r greater than 0.70) include leadership, mental health, decision-making, job demands-resources, motivation, conflict management, and sense of belonging.

The correlation results among the dimensions of each construct reveal four dimensions with a strong and positive relationship (r greater than 0.80): social support, job development, occupational health and safety (SST), and interpersonal relationships. Dimensions with a moderately high correlation coefficient (r greater than 0.70) include leadership, mental health, decision-making, job demands-resources, motivation, conflict management, and sense of belonging. Finally, relationships with low correlation coefficients that require confirmation (r less than 0.65) are contractual conditions, personal development, social environment, autonomy, work-life balance, administrative management, communication, and decision-making.

Finally, the development and validation of the model resulting from the research have substantial practical implications for the formulation of policies, plans, strategies, and decision-making in the realm of human resource management and the cultivation of healthy and productive work environments. The success of any project relies heavily on the team's familiarity with factors such as workplace well-being, quality of work life, and an enabling organizational climate

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